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PROGRESS OF THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

The present appearance of the work on the East River Bridge is shown in the accompanying engravings so clearly that any description, except of details, is quite unnecessary.

The point of view chosen by our artist is (for the larger engraving) on the high ground northeastward of the Brooklyn tower, so as to show not only the progress of the work, but the graceful structure of the tower, which from its great height appears to be very slender, notwithstanding its massive thickness and breadth of base.

Beneath the bridge is seen the harbor, looking southward, with Governor's Island and Castle William in the middle distance. Beyond is the lower bay, and beyond that the ocean. Only the southern point of New York is seen on the right. Across the mouth of the Hudson, which looks like a pointed bay, lie the Jersey shores and Staten Island. Across the bay, on the left, is the Long Island shore, with Bay Ridge and Brooklyn.

The smaller cut shows the underside of the bridge, without the timber flooring, as seen from the deck of a ferryboat passing beneath. The work of suspending the floor beams progresses with practical uniformity at both towers and on both sides of each tower, the design being to keep the strains on the masonry as equally balanced as possible. At this writing about twenty-five beams are in place on each side of the two towers, or something near a hundred in all. Suspender ropes are in place for more than twice as many additional beams, there being four suspenders to each beam.

From below the suspenders look like spider lines; they are, however, stout ropes of steel wire, from 1⅝ to 1¾ inches in diameter, and able to sustain a weight of 50 tons or more each, or five times the heaviest load likely ever to fall upon them. The bands by which the suspenders are attached to the cables above are of wrought iron, five-eighths inch thick by 5 inches wide. They were put on when the cables were being wound, and fit closely to the cables. On the outer side the ends of the bands terminate in two lugs, seven-eighths inch thick. An iron screw bolt, 1¾ inches in diameter, passes through the lugs to hold the suspender socket and to tighten the band around the cable. The bands were put on by the winders, who heated the backs of the bands in little forges until they could be opened far enough to let them go over the cable. The two ends of the band were then drawn together, a thin plate of iron being slipped between the cable and the hot band so as to protect the galvanizing of the wire of the wrapping until the band was cool. To these bands the suspender ropes are attached by means of wrought iron closed sockets. On the lower end of each suspender is a cast iron socket for the reception of the stirrup rods which hold the floor beam. The stirrup rods have long screw threads, by means of which the beam can be raised or lowered to regulate the floor grade, it being impossible to cut and fasten the suspenders to the exact length required.

The floor beams are made in halves at the steel works; are landed at the foot of the towers; are hoisted to the level of the bridge floor and run out upon a tramway to the point of suspension; and after being attached to the suspenders are securely riveted together, making a continuous beam the entire breadth of the bridge, or 85 feet. These floor beams are unlike any ever before used on a suspension bridge. They are 32 inches deep, 9⅜ inches wide, and weigh four tons. Each beam has two top and two bottom chords tied and braced together in the form of a triangular lattice girder. The chords are of steel channel bars. The main beams are suspended 7 feet 6 inches from centers, and between each pair of principal beams a lighter I beam is placed, resting on the truss chords, so that the floor planking will be supported and fastened every 3 feet 9 inches from centers. Wooden bridging will be inserted between the beams to resist the

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SUSPENDING THE FLOOR BEAMS OF THE EAST RIVER BRIDGE.

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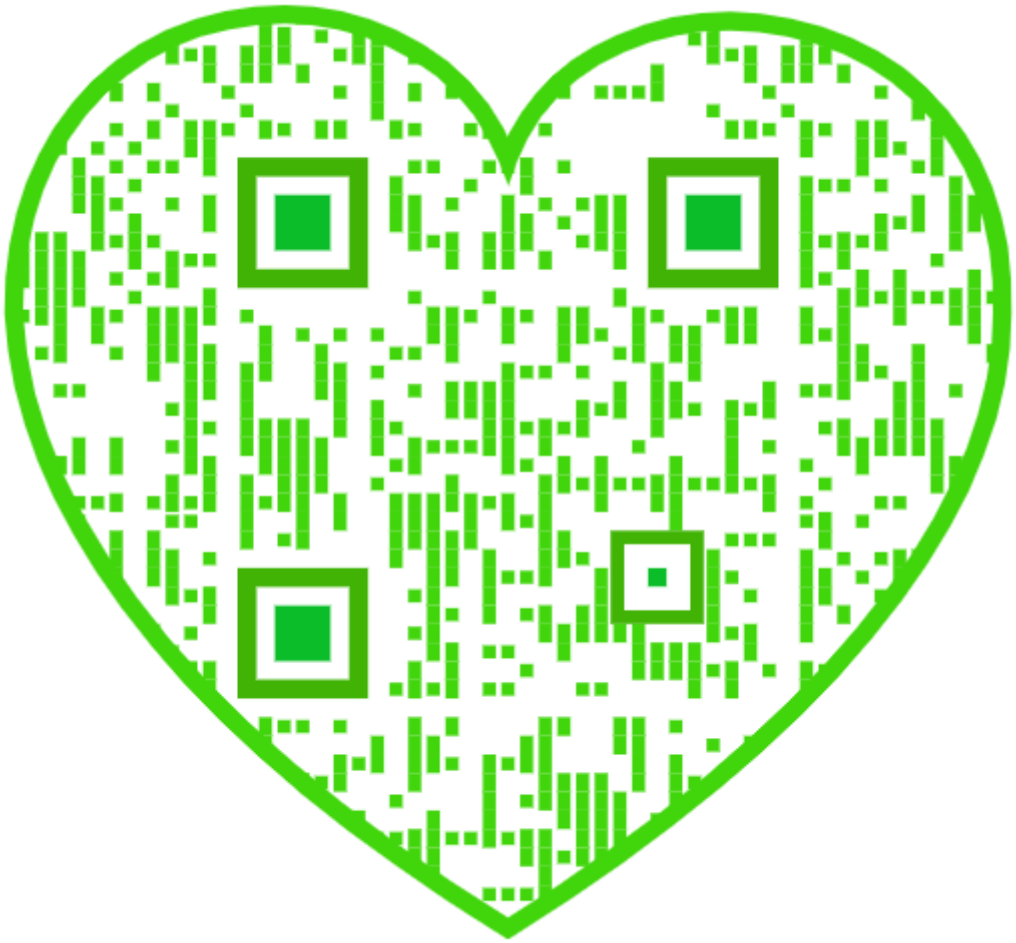

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HUMANITY VERSUS FANATICISM.

When the gentle Cowper declared he would not hold upon his list of friends him who would "needlessly set foot upon a worm," the poet's humanity touched high water mark, but stopped short of fanaticism. The fanatic would have left out the word *needlessly*.

The distinction between wanton cruelty and the infliction of pain for humanity's sake is an important one; and in refusing to make it the Society for the Prevention of Cruelty to Animals, more recently styled Humane Society, certainly do not ally themselves with the class of kindly and sensible people represented by the poet.

Good intentions cover a multitude of sins, and command respectful consideration, even where they do not give proof of wisdom; nevertheless, it is difficult to be patient with those who persistently prostitute the word *humanity* to justify courses which do not tend to ameliorate the condition either of beasts or men, collectively or individually, but rather bar the way to such amelioration. The tender mercies of the foolish, like those of the wicked, are often cruel; and of such a nature are those displayed by the officers of the society referred to when they seek by exaggeration and misrepresentation to stop all use of living animals for the scientific advancement of physiology and medicine. And it shows a pitiful state of popular intelligence, feeling, and judgment when legislatures can be persuaded by fanatics to pass laws making it a crime to pursue a line of scientific investigation which has been more fruitful than any other in knowledge helpful for the prevention and cure of disease. Pasteur's recent brilliant and most promising discoveries in connection with chicken cholera were no doubt made at the cost of considerable discomfort to a small number of guinea pigs, rabbits, and barn-yard fowls; but the certain issue of those discoveries must be to prevent an incalculable amount of distressing and fatal disease among these animals, with a possible issue of infinite value to humanity in furnishing a clew to a right understanding and treatment of many of man's diseases.

If the anti-scientific spirit of those who assume to be the official advocates of "humanity" shall prevail, all such investigations must become crimes to be prevented by the strong arm of the law, and men and animals may go on for ever dying of diseases which knowledge might mitigate or entirely prevent. That this spirit has already largely perverted a movement for the prevention of cruelty to animals into one which arrests the labors of those who would do most for the alleviation of pain in animals and in human kind, is only too plainly shown in the recent letter from a committee of the Medical Society of this State to the officers and members of the Humane Society, begging them not to interfere in certain proposed investigations touching the origin and prevalence of diseases among animals.

The letter, which is signed by nine of the best known and most honorable physicians of New York, says, after, referring to the diseases mentioned and their disastrous effects:

"So weighty are these interests that the Medical Society of the State of New York has appointed the undersigned a special committee on the subject of experimental medicine, charged with the duty of protecting such investigations from harmful interference.

"Such an interference is threatened by the efforts which have been made, in the name and with the implied sanction of your society, to prevent, by legal enactment, experiments on animals for medical and scientific purposes. Should these efforts succeed, they would have the effect to prohibit, within this State, a most useful means of investigation, and would be a lasting detriment to the cultivation and improvement of medicine. The committee can say, from their own knowledge, that the experiments in question are not performed in a spirit of wanton cruelty, nor in such a way as to inflict needless sufferings upon the animals employed; and that the information acquired by their means is often of the highest value for the protection of life and property.

"With you, we earnestly desire to prevent every form of unnecessary suffering. But we would most strongly draw your attention to the radical difference between the infliction of wanton cruelty and the serious and careful use of the lower animals for the benefit of humanity and of the brute creation; and we respectfully ask that the name and authority of your society may not be employed to the injury of the medical profession and of medical science."

The real friends of humanity and of the brute creation await the answer of the society named with no little interest. If, as there is reason to expect, the reply is not favorable to the work proposed by the Medical Society, the friends of humanity untainted by fanaticism will wisely refrain from giving aid or encouragement to the misguided society until a different set of officers give a more reasonable spirit to the administration of its affairs.

INTOLERANCE AMONG PHYSICIANS.

The unended, but we trust not endless question of professional recognition among the diverse schools of medical opinion and practice, has been brought once more into unseemly prominence in connection with the treatment of the late Earl of Beaconsfield.

Because the physician first in charge was nominally attached to a school of practice not accounted regular by those who arrogate to themselves the sole right to be so designated, the ordinary courtesies of the profession were refused him, and condemnation was urged against an associate who had the courage to be a trifle more courteous than the society rules allowed.

It is a pity that physicians cannot more generally rise above the traditional code of their craft in their professional consideration of this question, and look at the matter for a moment with the layman's unprejudiced eyes.

Were this done we are quite sure that there would be an end to the spirit of professional intolerance which so frequently comes in to embitter the intercourse or non-intercourse of physicians, to the hinderance of real progress in medicine and the lowering of the moral if not the professional standing of physicians in the estimation of intelligent laymen. Individually the majority of physicians recognize the present emptiness of the shibboleths of medical generations dead and gone. Years ago they meant a systematic abiding by this, that, or the other theory of medical practice; and A could not consistently consult with B or C, because they knew no common ground of theory or practice to agree upon. Their remedies being always different and their methods systematically opposed, there was at least a shadow of a reason for keeping professionally aloof. But knowledge comes though wisdom lingers, and sensible men in all the medical schools have learned the vital truths that all the schools possessed some truth and a great deal of error. The hard and fast lines of theory and practice have been abandoned by all; yet the medical codes are as intolerant as ever. In this, as in all cases, men in organized society prove to be more conservative, more bound by tradition and custom, than the individuals who make up the society.

In the Beaconsfield case the intensely conservative medical societies of London show, though unconsciously, the influence of the times. Formerly the reason for non-recognition would have been bold and clear: "The obnoxious physician is not of our school; therefore his practice is all wrong, and we can have nothing to do with the case so long as he is retained." That excuse could no longer be given, since it had practically lost all its original force. So the ground was shifted, and the reason for non-intercourse was said to be moral, not professional. "The offending physician's practice is eclectic, like our own," the regulars said, "but he is saling under false colors. In deference to the prejudices of the ignorant he professes to be a disciple of Hahnemann, when he is not. Hahnemann has no genuine followers nowadays. We cannot consult with a man who is a professional cheat, however reasonable his medical practice may be, or however admirable he may be in his private, non-professional character."

It will not take long, we fancy, for this flimsy pretext to wear itself out. And when that is gone the grounds for fence building between medical societies of different denominations will become shadowy indeed. It is high time they were lost sight of altogether. Intolerance is pretty nearly gone out of fashion. Men in all professions are learning that any pretense of monopolizing knowledge or wisdom or sincerity of purpose on the part of any clique or school is more likely to engender contempt than respect from the world at large. Men or sets of men in no way compromise their position mentally, socially, or professionally, by treating courteously those of different mental, social, or professional standing; while they do seriously compromise their claim to popular respect by courses which indicate on their part an overweening confidence that they are radically better or wiser than any one else. In this country, at least, men are free to do right in any way or under any name that may happen to fall to them; and it lies with no exclusive schools of thought or practice, but with the best judgment of all, to decide what in any case is within or without the bounds of right. The "regular" physicians, as they delight to style themselves, take an honorable pride in saying that they are hampered by none of the theoretical or practical "pathies;" that they are scientific and scientifically free to accept and use all knowledge and all methods of practice that promise to benefit their patients. Intelligent physicians, whom the regulars style "irregular," take precisely the same ground. There are reasonable differences of opinion as to what in any case is true or expedient. And neither the regular nor the irregular heightens our respect for his opinion or practice by refusing to confer with those whose opinions do not exactly coincide with his own. Still less do we respect those who would disfellowship each other for imaginary differences implied by accidental school names or outworn shibboleths of system or method handed down from days when toleration was regarded as a crime rather than a virtue. The scientific and practical advancement of the art of medicine is to be helped much more by the unrestricted conference, friendly criticism, and mutual respect of all the schools, than by mutual intolerance and partisan wrangling.

CORN AS FUEL.

Not a few good people, in parts where fuel is cheap and food dear, have been shocked by reports from the West of settlers resorting to corn for fuel. To the sentimentalist it seems dreadful, almost sinful, that grain which might feed thousands of hungry people should be "destroyed" in that way; and we have heard some speak as though it would be almost a virtue in the Iowa farmer to freeze to death and save the corn for its more legitimate use as food.

The *Iowa State Register* looks at the question in a more matter of fact and sensible way. It has tried corn as fuel, and finds that corn in the ear can be burned in stoves made for either soft or hard coal, and is an especially good fuel for cooking stoves. Moreover, the cost of growing corn in Iowa is so small that it is as economical to raise corn for

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fuel on the prairies as it is to import coal or grow wood, certainly off the lines of railway.

An acre of corn can be raised for about $6, including the rent of the land. Fifty bushels of corn will weigh 3,500 pounds, or equal to a ton and three-quarters of soft coal. This, at 15 cents per bushel (which is as much as corn was worth on the farm away from railroads last winter), would be as cheap for fuel as soft coal at $4 per ton. Two bushels of corn will make a fire which will keep a family warm all day, even in very cold weather.

Some recommend raising sunflowers for firewood, but they are not as good as corn. Nor need the talk about burning corn create any reluctance to removing to regions where they have to burn corn for fuel. It can be raised in one-tenth of the time and at less expense than timber can be raised for the same purpose, and the farmer may as easily and as conscientiously plant corn for fuel as sunflowers or trees. The *Register* is of the opinion, however, that, though the prairie farmers will occasionally have to burn corn to keep warm, they are not likely to choose it as fuel when they can get coal or wood.

HOW TO GET RID OF FOUNDLINGS.

The methods adopted by the almshouse officials of Philadelphia for getting rid of unwelcome babies appear to be complete and efficient to a degree never before approached in a modern public institution. The death rate is precisely 100 per cent. As the president of the city board of Guardians of the Poor frankly put it, when he protested against sending any more unfortunates to the almshouse: "All of them die. None of them live; and never have we raised a child out there."

The assertion seemed incredible, but an examination of the records of the institution found it to be true. It was discovered that few if any foundlings survived the almshouse treatment more than four months, and none lived more than six months. During the year 1880 there were brought to the institution 66 foundlings, of whom 30—of course the prettiest and apparently healthiest—were taken out for adoption. Of the 36 which were left all but one died within four months, and that one lived four months and one week. Nearly all died within four weeks of the time of entry.

Charges have been preferred against the management of the children's department of the almshouse by the society to protect children from cruelty, and at this writing the matter is still before the grand jury.

At the request of the president of the Board of Guardians, the condition of the foundling ward was investigated by the obstetrical staff of the almshouse, who attributed the terrible mortality to bad food, impure quarters, bad air, and insufficient attendance. As given in the *Record* the report mentions that in former years there were twelve resident physicians in the institution, thus obviating the necessity for the frequent change to which the foundlings are now subjected in their medical attendance. Under the present rules of the almshouse the number of resident physicians is twenty-three, and these are young physicians, fresh from college. As these physicians are rotated every month, the infants, who should have a permanent medical officer over them, have a new physician every four weeks. The report is also understood to say that the infant ward is ventilated from a cellar room, which is used as a drying room at high temperature for the pauper clothing, so that the foundlings are compelled to breathe a vitiated atmosphere; also that they are seldom if ever taken out of this room except during the summer time. It is also said that the medical staff connected with the almshouse has from time to time protested in vain against the food supplied; that patients have actually suffered from scurvy brought on by the food, and that the milk supplied has often been not only unfit for use, but that no attention has been given to repeated warnings that this was the case.

No doubt the official baby killers will to a man testify that everything has been done by them to discourage the perverse habit of the foundlings; and that it is only by the most painstaking carefulness that the little wretches have been kept alive so long on the average. But there will remain with the people at large a distressing sense of dissatisfaction with the results of the official tender mercies of the City of Brotherly Love. As a rule foundlings are not the best possible material for making men and women out of; still a death rate of 100 per cent in six months is a little too comprehensive to be accepted with composure, even when we are assured that "the subject has been one of serious study with the doctors of the almshouse for sixteen years," during which time, it is admitted, they have been unable to rear a single foundling in the institution. Many of those who are taken away and adopted live, but none of those survive who remain in the institution.

EXTINGUISHING PETROLEUM WITH CHLOROFORM.

The following experiments made some time ago are again published, in the hope that some of our readers may be induced to study the subject further and develop useful results.

The doctrine of the inflammability of chloroform has been generally accepted by chemists up to the present time. M. Würtz, in his great dictionary, states that a cotton wick dipped in chloroform will burn. M. Moigno has been making experiments which seem to point to a completely opposite doctrine.

If chloroform—$CHCl_3$—be submitted to the action of heat, another chloride of hydrogen is formed, an equivalent of chlorine and an equivalent of carbon are set at liberty. This proceeds from the reaction indicated by the formula, $CHCl_3 = Cl_2H + Cl + C$.

M. Moigno has established that pure chloroform, free more particularly from any trace of alcohol, does not burn. He has established, besides, that pure chloroform, mixed with inflammable liquids, destroys their inflammability. His experiment was an easy one to perform, and began by mixing petroleum and chloroform in the proportion of five parts of the former and one of the latter. This mixture will not burn with a wick. It is both uninflammable and incombustible, that is, until the greater portion of the chloroform has been volatilized. To give the experiment greater effect, it may be varied in its operation as follows: Let a liter of petroleum be spread over a surface of 10 c.c., set the liquid alight, and when it has well taken, pour 50 cubic centimeters of chloroform into the mass. The petroleum is at once extinguished. If, now, an attempt be made to rekindle the petroleum by any inflamed body the latter goes out on touching the mixture.

The discoverer of this curious property of chloroform, extending the scale of his experiments, next poured 4 liters of petroleum upon this same surface—10 c.c. This liquid mass, having a depth four times that of the amount first experimented on, was well lit, and was then successfully extinguished by the same quantity of chloride of hydrogen as before—50 cubic centimeters.

M. Moigno then proceeded: 1. To raise the vapors of explosive gases. The greater number of these mixtures lost their inflammability. 2. To expose a wick saturated with chloroform to a strong flame of alcohol. The flame became smoky, and an intensely opaque vapor of hydrochloric acid —HCl—was formed. 3. To pass the vapor of boiling chloroform into a good flame of alcohol. The flame is extinguished.

Practically what can one make of these experiments? Less, perhaps can be made of them in the way of process than in that of principle. They point to the possibility of the extinction of the obstinate and dangerous flame of burning petroleum.

The principal difficulty in this application of chloroform will consist in its high price, chloroform costing from ten to fifteen francs the kilogramme. This difficulty will, doubtless, prevail against the adoption of the new principle for the extinction of petroleum fires in large towns, where less costly means are at hand, but it will not hinder its adoption in a case considered till now almost beyond the reach of help—fire on board ship. In this direction M. Moigno thinks there is fair room for experiment and reasonable ground to hope for satisfactory results. If the indications given by laboratory experiments lead to good practical results an important problem will have been solved. It is not impossible to conceive that a ship could be furnished with a supply of chloroform, so stored as to admit of projection to any point where fire broke out. However considerable its first cost, this, as the chloroform keeps good from voyage to voyage, would be small for each one; and in presence of the terrible disasters it is capable of preventing, the question of cost disappears altogether.

PLEA FOR A GOVERNMENT PERPETUAL MOTION.

We publish in another column an extract from the remarkable report of Chief Engineer Isherwood to the Secretary of the Navy, in which he strongly urges, in fact almost implores that functionary to order the construction, at government expense of an experimental motor on Gamgee's plan. It will be seen that the hallucination of perpetual motion has taken complete possession of the Chief Engineer's brilliant intellect, and made him for the time being the laughing stock of the engineering world. This is much to be regretted, for Mr. Isherwood is an individual of superior attainments, and high capabilities. That such a man should embrace so palpable a delusion, and run off into such a labyrinth of absurdities as the report shows, is very strange.

The very best thing that the Secretary of the Navy can do is to clear out from the Washington navy yard at once, the whole crowd of Gamgee followers, and allow no more of the public money to be wasted on such stupid and irrational schemes.

It is unfair to Keely to allow this thing to go on. His perpetual motion is kept going by supplies drawn from willing victims—the private contributions of New York speculators. But it appears that Gamgee, Isherwood & Co., have an eye to the resources of the national treasury, to drive their wheels. In both cases it is money that makes the motor go.

The Partial Eclipse of the Sun.

The sun will be partially eclipsed May 27. The greatest obscuration occurs in latitude 69° 4′ north and longitude 90° 24′ east of Washington, or in northern Siberia, where 0·737 of the sun's diameter will be obscured 8·84 digits.

The shadow (Penumbra) first touches the earth in latitude 39° 9′ north and longitude 178° 40′ west from Washington, in central China, and leaves the earth in latitude 46° 20′ north and 17° 18′ west from Washington, or in central Minnesota—Morrison county. In the United States the southern limit of the eclipse begins on the Pacific coast, a few miles south of Astoria in Oregon, passing through Portland, Salt Lake City, and just south of Pueblo, Col., taking in Leadville, Denver, Colorado Springs, etc., where the eclipse will be very slight, and occur very late in the afternoon; at Denver at 6:13 P.M.; at Jefferson City, Mo., the middle of the eclipse occurs at sunset, the sun setting partially eclipsed. The sun will set more or less eclipsed throughout Missouri, Illinois, Iowa, Wisconsin, Michigan, Indiana, and Ohio. From Cairo, Ill., the boundary line of the eclipse, where it begins at sunset, follows the general direction of the Ohio river to Zanesville, thence to Buffalo, N. Y. Thus none of the Southern Atlantic or New England States are favored, and the North Central States will only see the sun set with a very small eclipse upon it.

The Gamgee Zeromotor.

Some of our American contemporaries are speaking with considerable hopefulness of a new motor which has been designed by Professor Gamgee, and which has recently been reported upon favorably by Chief Engineer B. F. Isherwood. This "zeromotor," as it is called, is, it appears from Mr. Isherwood's report, an apparatus by means of which the heat in water or other objects at a natural temperature may be utilized to vaporize ammonia under very considerable pressure, the gas so obtained being used to move a piston in a cylinder, and being employed with the greatest practicable measure of expansion. The ammonia gas becomes "by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee to the ammonia boiler whence it came. The cycle is thus a closed one; no material is lost, and no heat is rejected in matter leaving the engine." It is not quite clear how the gas can be "diminished in bulk" by "very expansive use," but we may pass this point by for the present. Mr. Isherwood goes on to speak of the engine utilizing the heat in natural objects, and therefore costing nothing in money for fuel, while he enlarges on the great value for naval purposes of such a motor, particularly to the United States, which does not possess coaling stations in different parts of the world, and finally he recommends his department to spend money in assisting Professor Gamgee to prosecute his experiments.

We must own to considerable surprise at finding an engineer of Mr. Isherwood's experience give his support to such a scheme. We need scarcely say that it is utterly chimerical to attempt to obtain continuous motive power in the manner in which Professor Gamgee proposes, as it would be to attempt to continuously propel a vessel by utilizing the power derived from a turbine driven by water entering through a hole in the vessel below the external water line. For instance, if we suppose such an engine as Professor Gamgee proposes to be constructed, and to be in the first place cooled to a temperature below that of surrounding objects, so that there may be a flow of heat into it, then unless the whole of the heat so flowing into the machine be converted into *external* mechanical work, the temperature of the apparatus will rise more or less gradually until it attains the temperature of objects around it, when the inflow of heat from these objects will cease, and as a matter of course the development of work also. We have said *external* work because any work expended in overcoming the internal frictional resistances of the machine will, as a matter of course, only aid the rise in temperature. As a matter of fact, Professor Gamgee's proposed zeromotor is simply a perpetual motion in disguise, and the sooner this fact is recognized the better for those who are concerning themselves with it.—*Engineering.*

The *Art Interchange* instructs its readers how to color a pine floor which is to be partially covered with rugs, a fashion which prevails to a great extent just now. Obtain at any house-painter's store turpentine and linseed oil (not boiled). Ask the clerk to put a little Japanese drier in the turpentine. Buy either burnt sienna or Vandyke brown, or both, according to the color of the rugs and the tint on the walls. These colors come put up in tin cans, smaller but otherwise similar to tomato or fruit cans. After the floor has been washed thoroughly clean, and dry, begin by mixing in another receptacle the oil, turpentine, and paint. The mixture should be so thin that it will run with liquid readiness. Lay it on with a brush, stroking the brush the way of the grain of the wood. Protect your hands with old gloves, and go over the floor with a rag. In fact, you will need two rags, one pretty well charged with paint, to rub in every crevice, and another rag to rub off any superfluous paint. Do not stop in a straight line across the grain of the wood, but carry the brush irregularly down, taking a hint from nature's lines in the wood. By mixing the burnt sienna and Vandyke brown a rich color will be produced without using the paint thick. The mixture should be so thin that the grain of the wood will show through. If too much turpentine is used the paint will rub off. If too little, your room will need more days to dry. Use twice as much oil as turpentine. Do not economize the oil, and be as prodigal in rubbing as your strength will permit.

AT a Berlin feather-dyeing establishment an ostrich feather dyed in shades with methyl-violet was laid upon a paper upon which some ammonia had been poured but had dried up again. After a time the feather became partially green, the green passing gradually into violet, and producing an extraordinary effect. This reaction is being utilized in feather-dyeing, and will probably be applied in the manufacture of artificial flowers.

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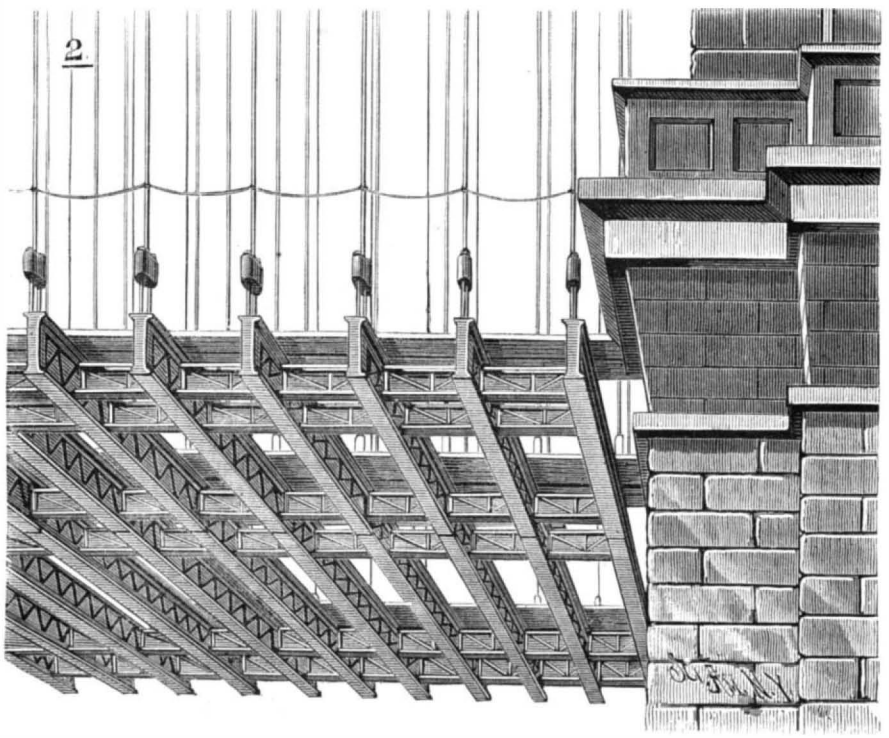
PROGRESS OF THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

[*Continued from first page.*]

strain of the over-floor stays. The longitudinal trusses are six in number, dividing the bridge floor into five sections. The two outside sections, 18 feet 6 inches in width, are for vehicles. A tramway will also be laid down in each, in case it may ever be desirable to run street cars across the bridge. Inside the carriageways will be two railways for cars to be propelled by an endless iron rope, operated by a stationary engine. Between the railways, and elevated 12 feet above them, will be a footwalk, 15 feet wide. This promenade will be the first part of the structure completed, since it will be needed for the workmen upon other parts of the superstructure. On both sides of the river the masonry of the approaches to the bridge is substantially finished.

An idea of the magnitude of the work already accomplished may be had from the following figures, which are furnished by Mr. E. E. Farrington, master mechanic of the bridge:

Length of the main span	1,595½	feet.
" " land spans, 930 ft. ea., total	1,860	"
" " New York approach	1,562½	"
" " Brooklyn approach	971	"
Height of main span above water	135½	"
Depth of N. Y. foundation below high water	78½	"
Depth of Brooklyn foundation below high water	44½	"
Size of N. Y. caisson (for foundation)	172x102	"
" " Brooklyn "	168x102	"
Cubic yards of masonry, N. Y. tower	46,945	
" " " " Brooklyn tower,	38,214	
Size of towers at high water mark	140x59	feet.
" " " " top	136x53	"
Total height of tower above high water	271½	"
Height of roadway at towers	119	"
" " arches above roadway	117	"
" " towers " "	159	"
Width of openings through towers	33¾	"
Size of anchorages at base	129x119	"
" " " " top	117x104	"
Height in front	85	feet.
" " rear	80	"
Width of flooring	85	"
Grade of roadway	3¼ ft. in 100	"
Number of cables	4	
Diameter of cables	15¾	in.
Length of each cable	3,578½	feet.
Wrapping wire on each cable	243 miles 943	"
Number of wires in each cable	5,434	
Total length of wire in each cable	3,515	miles.
Number of suspenders—		
Each cable, main span, 208; in all	832	
" " each land span, 86; in all	688	
Total	1,520	
Number of post bands—each land span, each cable, 35; in all	280	
Number of double floor beams supported by cables	450	
Strength of each suspender	140,000	lb.
Sustaining power of each cable	12,000	tons.
Greatest weight on a single suspender	20,000	lb.
" " " " " cable	3,000	tons.



THE FLOOR BEAMS FROM BELOW.

NOVEL OIL SEPARATOR.

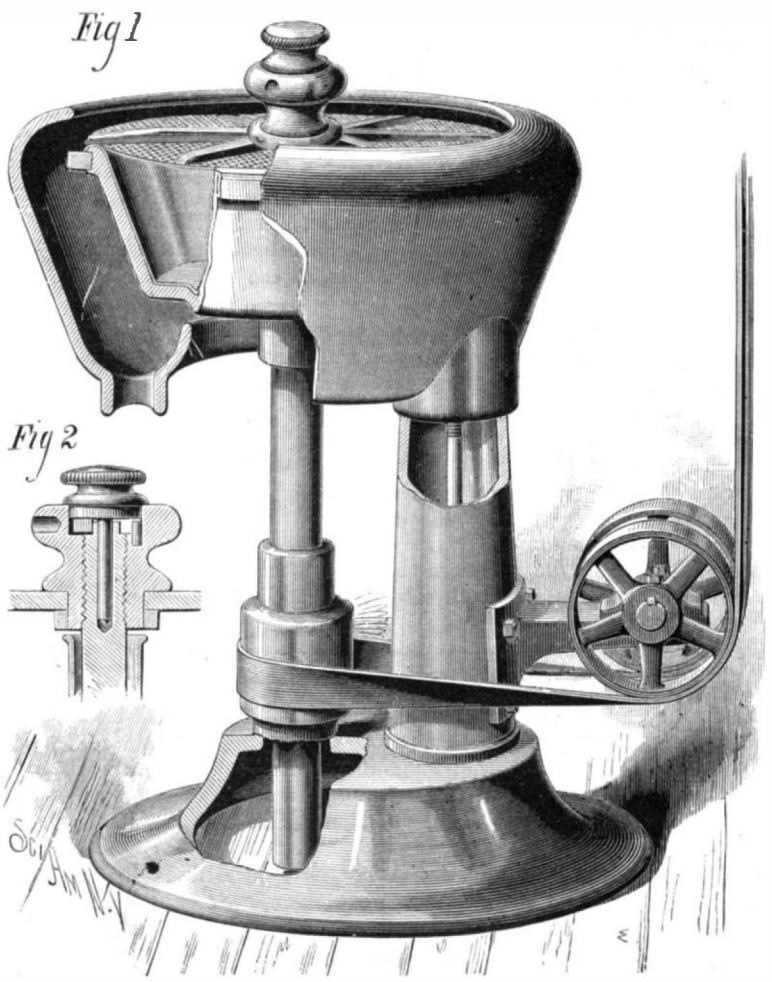
We give an engraving of a machine for separating oil from metal chips, such as turnings, drillings, chips from bolt and screw machines, and from small articles such as screws, bolts, and nuts, which in their manufacture are necessarily coated with oil, much of which is commonly lost. By the use of this machine the oil carried by the chips, crews, etc., is very quickly separated from the metal by centrifugal action, leaving only a slight film, which is beneficial rather than otherwise.

The article from which the oil is to be separated is placed in a removable conical pan in the revolving drum, and confined by a metal cover fastened securely over the top of the drum by the lock nut shown in Fig. 2. The machine shown in the illustration is about thirty inches high and requires a floor space about twenty inches square. It revolves at a speed of 2,000 revolutions a minute, and is noiseless and free from jar. The machine is well made, carefully finished, and is accompanied by a shaft and hangers. It is in use in several of our largest and best machine shops, giving complete satisfaction.

Further information in regard to this useful invention may be obtained by addressing Mr. C. F. Roper, P. O. Box 1211, Boston, Mass., or Hartford, Conn.

Making Old Rails into New.

But few people are aware, says the *Indianapolis Journal*, of the immense amount of handling that it requires to convert an old iron rail into a new one. From the time it arrives in the yard at the Indianapolis rolling mill until it is shipped out, a rail is handled thirty-one times. The process is as follows: It is first unloaded from the car, then picked up and run on a set of rolls to the shears, then cut up, when cut piled into fagots, then loaded on to a barrow and charged into furnace, heated to a welding heat, then hauled out and placed on iron buggies, run to weighing rolls, handled six times, until finished to a bloom, then returned to the buggy, carried to a repeating furnace, brought to a welding heat, then returned to the rolls on a buggy, passed through the rolls nine times, then run to saws where both ends are put off at once, then laid on the cooling bed; when cold, placed under the straightener, which takes out all minor crooks. The burr on the ends is then filed off, when the rail is inspected, then taken to the punching machine and fitted for splice bars, thence to the slotting machine, where it is slotted for the spikes; then the rail goes on the benches in the yards and from thence to the cars.



ROPER'S OIL SEPARATOR.

MISCELLANEOUS INVENTIONS.

Mr. Charles T. Sands, Jr., of Nassau, New Providence, West Indies, has patented a cheap, simple, and convenient device for enabling persons to escape with safety from burning buildings. It consists, in combination with a fire escape, of novel devices for arresting or regulating the descent of the basket or cage of the fire escape.

An improved holder for nuts and dies has been patented by Mr. Edward Squires, of Beaverton, Oregon. The invention consists of a frame or box for holding dies or nuts, and is provided with a sliding perforated bottom and an adjusting screw, and is held between the forked end of a rod or hand brace.

An improved means for preventing escape of sewer gas from waste pipes has been patented by Mr. Willis Knowlton, of New York city. Heretofore cocks have been applied to waste pipes for closing such pipes when not in use, but no provision has been made for preventing overflow, or else the arrangements have been complicated and liable to get out of order. The object of this invention is to provide the waste pipe with a valve whereby it can be closed, and to combine with this device valves in the water pipes and means for operating them, whereby the waste pipe shall be automatically closed, and the overflow pipe of the basin opened simultaneously with the water pipe.

Mr. James Corr, of Jamaica, N. Y., has patented an improved cigar holder, constructed to inclose the cigar entirely while it is being smoked, thus avoiding danger of fire and preventing the ashes from being an annoyance.

An improved metallic sole for boots and shoes has been patented by Mr. William T. Burrows, of East Dubuque, Ill. The object of this invention is to increase the durability of the boot or shoe sole, and it consists of a plate of metal of the shape of the sole, and designed to be secured thereon, made with parallel cuts or slits, that alternately begin at the opposite edges and extend nearly across the plate, thereby forming, in effect, a series of parallel end-connected crossbars.

A device whereby the driving reins will be securely held and can be easily and quickly inserted and detached, has been patented by Mr. Jonathan S. Pitcher, of San Diego, Cal. It consists in posts having one or more cams hinged to them, the cams being held forward by springs pressing against pins attached to the cams and prevented from being forced too far forward by stops attached to the clamp. The device is intended for attachment to the dashboard of the vehicle.

A cheap and strong ear for earthen pots and pans, attached so that it does not interfere with the cover, and so that the strain upon it will not break it loose from its fastening, has been patented by Mr. Milton T. Geren, of New Brighton, Pa.

An improved horse power for gins, etc., has been patented by Mr. Willis H. Harvey, of Somerville, Tenn. The invention relates to an apparatus for transmitting motion from a prime motive power to the machinery intended to be driven by it, the object being to reduce the cost of construction, to adapt it to any present gin house without interfering with or moving the gin stand or lint room, and to economize in space and in power.

An improved governor for vulcanizing apparatus has been patented by Mr. William E. Gwyer, of New York city. This governor is for regulating the flow of gas to the steam generators of vulcanizing apparatus, by which the temperature in the vulcanizing chamber is maintained at a uniform point, the object being to utilize an ordinary pressure diaphragm for that purpose, and also to allow escape from the steam space or steam generator of expanded air, which, when allowed to remain, interferes with the indication pressure.

An improved truss, which is simple, durable, convenient, and effective, has been patented by Mr. Henry E. Garst, of Cincinnati, Ohio. The truss is provided with two pads adjustably attached to a spring bar, which is pivoted to one end of the truss spring by a pin passing through a slot in the end of the truss spring, and the other end of the spring is attached in a like manner to the truss cushion, to which the belt is fastened.

An improved shovel handle has been patented by Mr. Wm. H. Johnson, of Industry, Maine. This invention relates to that class of wooden handles for shovels, and similar implements, which are bifurcated and the parts curved in opposite directions to receive the round or hand gripe between them at their ends. In the improved handle the round or hand gripe is firmly secured between the curved arms in such a manner that it cannot revolve.

An improvement in pool tables has been patented by Mr. John Jefferson, of Columbus, O. This invention relates to that class of billiard or pool tables which are provided with pockets; it is a device for conducting the balls from the pockets to a large pouch or pocket at the foot of the table. It can be attached to old tables, using the same pockets without changing the external appearance.

A simple, convenient, and efficient device for cleaning knives and forks has been patented by Mr. Benjamin J. Howe, of Sing Sing, N. Y. The invention consists of a scouring table mounted on a box which is open at both ends of the table, and of a sliding rubbing block guided by or in grooves for applying the polishing powder to the knives or forks.

Mr. Charles W. Stiff, of Foxborough, Mass., has patented an improved lamp extinguisher, by means of which a lamp can be extinguished immediately at any desired time, and which also operates automatically if the lamp is accidentally upset. The invention consists in a lamp burner having two extinguishing caps pivoted to the wick tube, or some other suitable part of the burner, in such a manner that they can close over the top of the wick tube and thus extinguish the flame.

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Mr. Richard Kersey, of Lexington, Ky., has patented a simple and compact middlings purifier that will thoroughly separate the flour and bran from the middlings without creating dust in the mill, and that will enable the operator to grade the middlings at will.

An improved heating apparatus for sanitary purposes has been patented by Mr. William R. Macdonald, of Allegheny City, Pa. The object of this invention is to supply at small cost an effective apparatus of simple construction for the sanitary uses of heating, ventilation, and disinfection of buildings—public and private—sewers, drains, and vaults, isolated, sick, or other apartments, water closets, and mines, to be used either solely as a heater or as a heater, disinfector, and ventilator, or for outdoor use as a disinfecting ventilator alone.

A machine which will receive labels or other sheets or prints as they are delivered from a varnishing or enameling machine, and keep them in slow motion through the air for a sufficient length of time to dry the varnished surfaces, without smearing them or making contact between the varnished sheets till they are dry, has been patented by Mr. Joseph E. Hinds, of Brooklyn, N. Y.

An improved machine for grinding glassware, such as tumblers, goblets, and similar articles, has been patented by Mr. Emmanuel Hutter, of Rive de Gier, France. It is simple in construction and operation. and can conveniently be adjusted and regulated to suit the various forms and sizes of the articles and the grinding stones.

The Electricity of Atoms.

The most novel conclusion of Professor Helmholtz, in his recent Faraday lecture, is to the effect that the atom of every chemical element is always united with a definite unvarying quantity of electricity. This quantity stands in close connection with the combining power of the atom which modern chemistry has termed quantivalence. For if the amount of electricity belonging to the monad atom be taken as the unit, then that of the dyad is two, that of the triad three, and so on. "If," says Professor Helmholtz, "we conclude from the facts that every unit of affinity of every atom is charged always with one equivalent either of positive or of negative electricity, they can form compounds, being electrically neutral, only if every unit charged positively unite under the influence of a mighty electric attraction with another unit charged negatively. You will see that this ought to produce compounds in which every unit of affinity of every atom is connected with one—and only with one—other unit of another atom. This is, indeed, the modern chemical theory of quantivalence, comprising all the saturated compounds."

A Rare Japanese Medal.

At the late meeting of the Philadelphia Numismatic and Antiquarian Society, a member exhibited a very rare and valuable Japanese gold medal, termed "Shinroku Oban," 400 years old, which excited interest not only from the credentials accompanying it, but also from the manner in which it comes to this country. A few years ago the Japanese Ambassador at Washington asked the advice of Col. Thomas A. Scott in relation to the selection of an American engineer to superintend the construction of certain important works contemplated by the Japanese Government. Col. Scott suggested Mr. Joseph W. Crawford, of Pennsylvania, then engaged upon the Texas Pacific Railroad. Mr. Crawford sailed for Japan, and commenced the construction of an artillery road around the island of Yesso, the northernmost of the Japanese possessions, bordering on Russia. This road, although primarily constructed for the transportation of troops and cannon, was graded so that rails may be laid at any time.

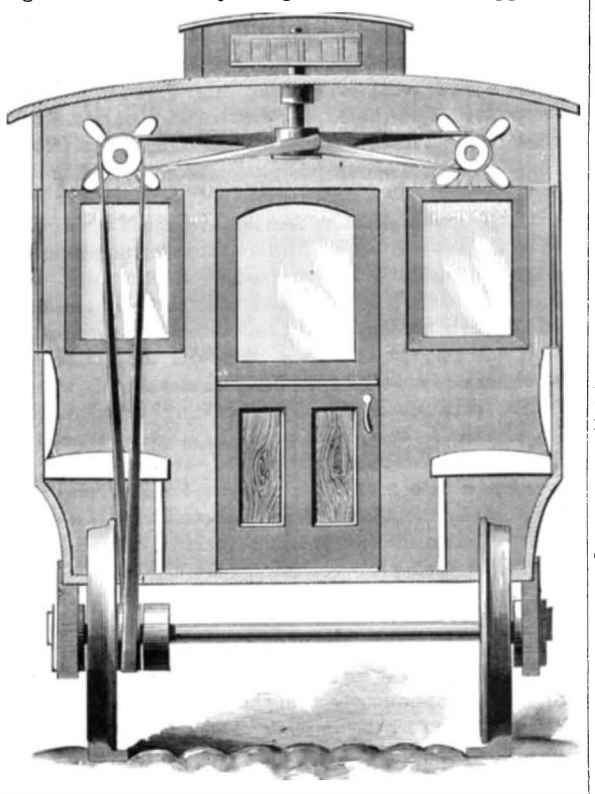
Owing to the precipitous rocky cliffs, the climate, and other causes, this undertaking was regarded as exceedingly difficult to accomplish. The manner, cost, and celerity with which this road was completed proved so acceptable to the Japanese Government that Mr. Crawford was sent to this country to purchase supplies, equipment, and assistants to construct the Polonai Railroad. The road was completed and opened with formal ceremonies last November, on which occasion Mr. Crawford was decorated with the Order of the Rising Sun, and as a particular mark of favor this "Shinroku Oban" was presented to him by the government, through Gen. Koroda, Colonial Secretary and member of the Privy Council of the Mikado. The medal is supposed to be one used at the time of Hiyashiyama (a Tycoon who reigned over the empire about 400 years ago), as a reward to any person of an extraordinary merit.

Sleigh Bells—How Made.

It has, no doubt, been a mystery to many how the iron ball inside of sleigh bells got there, and it is said to have taken considerable thought on the part of the discoverer before the idea struck him. In making sleigh bells the iron ball is put inside a sand core, just the shape of the inside of the bell. Then a mould is made just the shape of the outside of the bell. This sand core, with the jinglet inside, is placed in the mould of the outside, and the melted metal is poured in, which fills up the space between the core and mould. The hot metal burns the core so that it can be all shaken out, leaving the ball within the shell. Ball valves, swivel joints, and many other articles are cast in the same manner.

NOVEL CAR COOLER.

We give an engraving of a device lately patented by Mr. Isaac H. Fridenberg, of Philadelphia, Pa., for cooling passenger cars and for improving ventilation. The apparatus



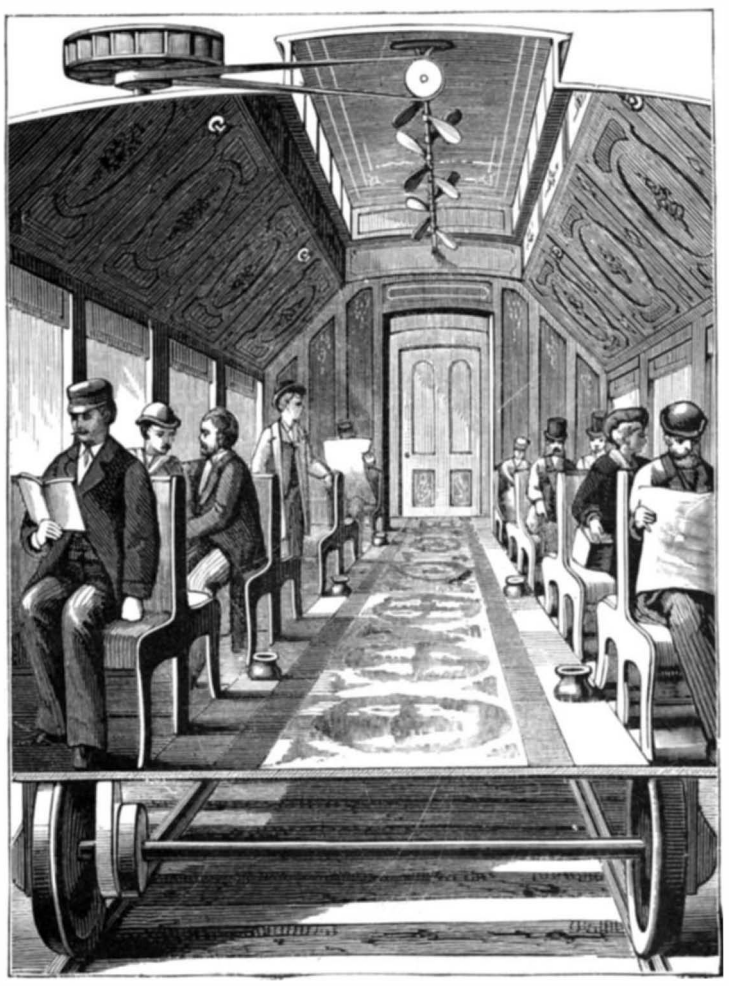
COOLER FOR HORSE CARS.

is very simple indeed, consisting of a shaft running lengthwise through the car, and carrying a number of wings like screw propeller blades, which, as they revolve, set the entire body of air in the upper part of the car in motion, and produce currents in the lower portion of the car which have a cooling effect similar to that produced by so many fans.

When the device is applied to steam cars motion is imparted to the propeller shaft by a wheel mounted on the roof of the car and driven by contact with the air as the car moves along. A belt or a shaft and miter gears may be employed to transmit the motion. When the device is applied to horse cars the power to drive the propeller shaft is taken by a belt from one of the axles.

The discomforts of summer travel will be greatly relieved wherever this invention is applied. It has a large field in sleeping cars, where a comfortable and wholesome atmosphere is usually wanting, and in ordinary passenger cars and street cars it will insure a degree of comfort which should warrant its general application.

Further information in regard to this useful invention may be obtained by addressing Mr. I. H. Fridenberg, S. W. corner 7th and Poplar streets, Philadelphia, Pa.



FRIDENBERG'S CAR COOLER.

Industrial Secrets.

A century ago what a man discovered in the arts he concealed. Workmen were put upon an oath never to reveal the process used by their employers. Doors were kept closed, artisans going out were searched, visitors were rigorously excluded from admission, and false operations blinded the workmen themselves. The mysteries of every craft were hedged in by thick-set fences of empirical pretensions and judicial affirmation. The royal manufactories of porcelain, for example, were carried on in Europe with a spirit of jealous exclusiveness. His Majesty of Saxony was especially circumspect. Not content with the oath of secrecy imposed upon his workpeople, he would not abate his kingly suspicion in favor of a brother monarch. Neither king nor king's delegate might enter the tabooed walls of Meissen. What is erroneously called the Dresden porcelain—that exquisite pottery of which the world has never seen its like—was produced for two hundred years by a process so secret that neither the bribery of princes nor the garrulity of the operatives revealed it. Other discoveries have been less successfully guarded, fortunately for the world. The manufacture of tinware in England originated in a stolen secret. Few readers need be informed that tinware is simply thin iron plated with tin by being dipped into the molten metal. In theory it is an easy matter to clean the surface of iron, dip it into a bath of boiling tin, remove it enveloped with a silvery metal to a place of cooling. In practice, however, the process is one of the most difficult in the arts. It was discovered in Holland, and guarded from publicity with the utmost vigilance for more than half a century. England tried in vain to discover the secret, until James Sherman, a Cornish miner, insinuated himself master of the secret, and brought it home. The secret of manufacturing cast steel was also stealthily obtained, and is now within the reach of all artisans.

Facts about Sahara.

Recently Dr. Lenz, who has just returned from an expedition across the Sahara desert to Timbuctoo, gave a lecture before the Paris Geographical Society. Dr. Lenz decisively condemns as impracticable the project of flooding the Sahara. The fresh water fossils, which are met with in many parts, show that the Sahara is not the bottom of a dried-up sea. The temperature is not nearly so hot as might be expected; wild beasts are rare, and the most formidable enemies to be met with are the Touraeg tribes, who, according to report, have recently massacred the French Trans-Saharan Expedition. On the whole, the impression is conveyed that the Sahara is not half as black as it has been painted, and that it is entitled to an apology from the entire civilized world.

Wild Rice.

At a recent meeting of the Academy of Sciences, San Francisco, Capt. R. W. Simpson made an interesting statement detailing his efforts to acclimatize the *Zizania aquatica*, or wild rice, which grows so plentiful in some ponds, lakes, and rivers of Canada, extending north to Mackenzie River, nearly to within the Arctic circle. It grows annually from seed, and induces the presence of enormous flocks of wild fowl in the autumn, who visit these rice lakes and extensive beds for food. At Lake Erie it grows in water six to eight feet deep, and millions of reed birds, as well as bucks and other water fowl, resort there, and afford very fine shooting. Sportsmen's clubs East are taking means to extend its growth, as it attracts game of all kinds. In Rice Lake, where it grows prolifically, it has been cut before seed time by manufacturers, who find its fiber, taken from the under surface of the water to a depth of six or seven feet, to be very valuable. It affords the strongest kind of fiber known for making bank note parchment paper. The Canadian Government are now trying to cultivate and stimulate its growth all over the inland waters of the Dominion. Two friends of Capt. Simpson have each sown thirty bushels of this rice seed, in Wales' Pond, Maine, and he desires to call attention to it, as an element likely to prove very useful in improving the shooting in our State, and as such capable of contributing largely to increase our food supply. Different varieties of it are known, but they all belong to one single species, varying according to climate and location. Capt Simpson had tried to make it grow in Oregon and California, but had failed. He now learned that the seed needed first to be soaked in lukewarm water.

EARTH FUNGUS AS FOOD.

Dr. Harkness exhibited colored drawings of a new species of earth fungus, first discovered in Golden Gate Park by Mrs. Dr. Mary Curran, which, if to be had in quantity, would prove a valuable article of food. He called it the *Octaviana*. Its spores are distributed underground, in the same manner as those of the famous luxury called truffles. He said he had hunted annually for fifteen years under the small oak groves of California, hoping to discover truffles, which in Paris are eagerly sought after as a great delicacy, and sell readily there at $4 a pound. French scientists with whom he has conversed assure him that our State has conditions which convince them that they will undoubtedly be found here, when a large number of observers are trained to hunt for them systematically. In Europe they are often rooted up

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by hogs, who are very fond of them, and have a remarkable faculty of finding them. They grow just under the surface, within four or five feet of oak trees, in fields, and are highly esteemed by epicures the world over. Mr. Clayton, now in Sonoma, once found some red truffles, not the genuine variety, but a very good article of food, and a fair substitute, among the foothills around Santa Clara, and off a little from San José. He had himself dug up some interesting earth puff-balls at Roseburg, and found them edible and quite good for a fungus. Feeling confident that truffles exist on our coast, he recommended farmers engaged in grubbing around oaks to hunt for them especially, and try and recognize them, for thus they could add a new industry to our State, and increase the value of their farms. Capt. Simpson recommended hunting among the heavy oak forests of Oregon and Willamette valley.

THE GAMGEE PERPETUAL MOTION. *

Chief Engineer Isherwood goes on to say in his report to the Secretary of the Navy, which is dated New York, March 19, 1881:

From observations made by Professor Gamgee in the experimental working of this machine, he deduced the possibility of what he terms a zeromotor, in which, by means of properly adapted apparatus invented by himself, the heat in water or other objects at ordinary atmospheric temperatures may be utilized to vaporize liquid ammonia under very considerable pressures, but within the control of known means of retention. The high pressure gas thus obtained being used with the greatest practicable measure of expansion on a working piston generates power, becoming by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee to the ammonia boiler whence it came. The cycle is thus a closed one; no material is lost, and no heat is rejected in matter leaving the engine. The work done by the engine is due to the difference in bulk of the material when it enters and when it leaves the boiler, that difference being caused by the heat derived from water or other natural objects in the ammonia boiler and from the refrigeration resulting from the transmutation of a portion of this heat by the engine into the mechanical work performed by the latter. That this difference of bulk exists is indisputable, and if the proper mechanism can be contrived to utilize it, the idea of the zeromotor becomes realized. It will be observed that this power has not been obtained from artificial heat produced by the combustion of fuels, but from the heat of natural objects at ordinary atmospheric temperatures, and therefore costing nothing in money. This is made possible by the fact that liquid ammonia gasifies under considerable pressure at ordinary atmospheric temperatures, the sole difficulty in constructing the zeromotor being to find the means of economically condensing the gas after it has been used on a piston. Were it not for the refrigeration due to the expansive working of the gas, the condensation would have to be obtained by the application, externally to the condenser, of artificially produced cold, and the zeromotor could not be made a commercial success. It is only by obtaining the lower limit of temperature from the action of the engine itself, while the higher limit is furnished without money cost by natural objects at atmospheric temperatures, that commercial success becomes possible.

A MOTOR TO SUPERSEDE THE STEAM ENGINE.

The purpose of the Department in ordering an examination of Professor Gamgee's ice making machine was not to obtain an opinion on its ice making merits, but one as to whether his observations on the behavior of ammonia in the process were sufficiently accurate to warrant his inference of the practicability of constructing a successful zeromotor for industrial uses—a motor, in short, destined to supersede the steam engine. Accordingly the undersigned closely investigated the working of the apparatus. The facts of liquid ammonia gasifying at ordinary atmospheric temperature under very high pressures, and of that gas undergoing very great refrigeration when used expansively in doing work, are not called in question by any one. Both are well known phenomena. The special fact to be observed was whether any part of the ammonia which entered the cylinder as a gas left it as a liquid, and so far as the form of the apparatus allowed any observation to be made, such appeared to be the case. The possibility of the invention of a new motor of incalculable utility would seem to be established, and in view of the immense importance of the subject to the Navy and to mankind at large, I strongly recommend it to the serious attention of the Department, suggesting further that whatever facilities the Department can, in its opinion, consistently extend, be allowed to Professor Gamgee for the continuance of his important experimental inquiries in the Washington Navy Yard. He is most anxious to bring his invention, with the least possible delay, to a crucial test by the completion of the necessary mechanism, and its submission to any board of experts which may be ordered to experimentally ascertain its merits. For this purpose he proposes to use such parts of his present ice making machine as can be recombined in his zeromotor, adding the other necessary parts, and thus producing, with but little loss of time, an embodiment of his idea that will by simple trial show whether an unquestionably correct theory has been successfully reduced to practice.

Professor Gamgee has perfected the calculations and drawings for the mechanism required to give practical effect to his invention, and there remains only to execute the mechanical work. He proposes to use the steam cylinder of his ice-making machine as the ammonia cylinder of the new motor, the present ammonia condenser, and the present ammonia boiler as a low pressure boiler, adding another ammonia boiler as a high pressure boiler. These, together with the ejector between the condenser and the low pressure boiler, a small pump for pumping liquid ammonia from the low pressure to the high pressure boiler, etc., will constitute the zeromotor—a machine, as will be apparent from this brief description, of the simplest, cheapest, and most manageable kind.

In the high pressure boiler the liquid ammonia will be gasified by the heat in water of atmospheric temperature to the pressure normal to that temperature. In the low pressure boiler ammonia is kept at a considerably less tension than in the high pressure boiler, and with this lower pressure ammonia gas the engine is operated, the gas being used as expansively as practicable and made to do work during its expansion, thereby becoming refrigerated, greatly reduced in bulk, and partly liquefied. Immediately on being exhausted the cooled and shrunken gas, and whatever liquid of condensation may be mingled with it, are discharged by the ejector from the condenser into the low pressure boiler, the ejector being worked by the higher pressure in the high pressure boiler. As a result the low pressure boiler is continually receiving ammonia and heat from the high pressure boiler. This excess of ammonia in the liquid form is pumped by an ordinary pump from the low pressure back to the high pressure boiler, while the excess of heat is continuously being converted into the mechanical work done by the engine. There is also the extinction of such part of the heat in the high pressure ammonia gas working the ejector as is due to the work done by it in forcing the contents of the condenser into the low pressure boiler. Of course the cylinder, heat condenser, the low pressure boiler, and their connections are protected from receiving heat from the atmosphere and surrounding objects by a non-conducting substance.

NO FURTHER USE FOR COAL.

The plan proposed is far from chimerical. It is based on well demonstrated thermodynamical principles. The whole is definite and precise, both in theory and mechanical detail, nor can it be shown, *a priori*, that there is not a fair prospect for success. There can be no doubt that the product of the pressure and volume of the contents of the condenser which are to be forced into the low pressure boiler, is less than the product of the pressure and volume of the ammonia gas which leaves that boiler to operate the engine, and that this difference which has not been produced by the external application of artificial cold, but by the working of the machine itself, is available for the production of power for industrial purposes. All that remains is to give the system a practical test in order to ascertain whether the mechanism proposed will act efficiently enough to realize the expected result. Should this prove to be the case, the steam engine will, within the near future, be certainly superseded by the zeromotor, for the great item of coal, whose cost is the principal expense of operating the former, will be wholly eliminated with the latter. If it can once be practically shown that a very much cheaper, lighter, and a far less bulky mechanism than the steamengine, including for the latter its boilers and, in case of steam vessels, the coal bunker and its contents, can be employed for the production of power to any amount without the use of fuel, nothing can prevent its introduction into general use for all industrial purposes, with the vast result of a great cheapening to mankind of every article of manufacture, from the daily bread of the poor to the luxurious textures which robe the rich. The whole world is concerned in the solution of this problem, and the poorer the person the greater is his interest in it. The source of heat for the steam engine is the continually diminishing supply of coal—a diminution that will be severely felt some centuries hence; but the source of heat for the zeromotor is as inexhaustible as the sun himself, and will last undiminished as long as he shines.

The success of the zeromotor is of more importance to the Navy of the United States than to the navies of the great maritime powers of Europe with which it may come in collision, because those powers have colonies and coaling stations on the farthest shores, while the United States possesses neither, and would consequently, in naval warfare, be at great disadvantage for want of coal—its navy, as a rule, having to render service within a reasonable distance of its own coasts the sole base of supplies. If coal, however, can be dispensed with, we are at once placed on an equality in this respect, and our cruisers enabled to penetrate the remotest seas as easily as those belonging to countries having possessions there.

VALUE OF THE ZEROMOTOR TO OUR NAVY.

The enormous importance of a motor capable of superseding the steam engine and furnishing power without the combustion of coal can be estimated from the fact that it would produce an industrial and consequently social and political revolution equal to what was effected by the introduction of the steam engine. The whole of modern society is based on the steam engine which mainly has made the difference between the ancient and the present world, for our civilization would be impossible without it. It is the inanimate slave which performs the labor of mankind, freeing them from the greater part of their drudgery and giving them the time and means for culture.

I have ventured these few remarks to show the nature and scope of Prof. Gamgee's invention, which is not that of a machine for the application of power, but for the immensely more important purpose of generating power itself, so that, strictly speaking, it includes as a basis all other machines. I have wished to show this in order to make clear how different is his invention from those of others who may ask to have their apparatus tested in a Navy Yard, and to bespeak for it the most favorable consideration of the Department.

Professor Gamgee and able assistants—among whom is Mr. W. E. Sudlow, an accomplished mechanical engineer, thoroughly versed in the theory and practice of his profession—are well acquainted with the difficulties to be overcome. They are quite aware of all the objections that can be raised, and have well considered the means of obviating them. The subject has been carefully studied, and there are brought to bear upon it the requisite scientific and engineering information necessary to give it an exhaustive treatment. His engine, like the steam engine, is a heat engine, and produces power by the conversion of heat into mechanical work, the same quantity of work consuming in both cases the same quantity of heat, but with this immense practical difference, that the heat for his zeromotor is freely furnished to hand by nature, while for the steam engine it has to be excavated from the depth of earth and afterwards handled and transported by expensive manual labor.

What is now mainly desired is that Professor Gamgee may be permitted to prosecute his experiments at the Washington Navy Yard to a conclusion, and there bring his engine to a practical test with as little delay as possible. Should the Department be able to grant this, the favor will be well and properly bestowed in the interest of the Navy and of the world. Submitted with great respect by,

Sir, your obedient servant,

B. F. ISHERWOOD, Chief Engineer.

* From the Report of Chief Engineer Isherwood, U. S. A., on the Gamgee Zeromotor.

Bitter Substances Developed during Fermentation.

We have on several occasions drawn attention to this subject, and have expressed an opinion that peculiar bitter substances are occasionally developed during the fermentation of saccharine fluids. As a rule the bitter flavor imparted by the hop is sufficiently strong to mark this extraneous bitter even if it be produced at all, but it must be within the experience of almost every brewer that beers do sometimes acquire an intense and peculiarly bitter flavor quite beyond anything that can reasonably be expected from the hops used. Some experiments by Mr. W. H. Langbeck recorded some time since, point to the occasional existence in fermented liquids of a bitter principle allied to colchicine. He prepared two samples of a fermented liquor from solution of glucose with small quantities of tartar, tartaric acid, kino, and a few drops of a mixture of formic and œnanthic ether. Fermentation was set up by means of sound pressed yeast, and was maintained at a temperature of 64° to 68° Fah. One sample, filtered through flannel after four days and allowed to stand for three weeks in a stoppered cask at 47° Fah., yielded a pleasantly vinous liquid. The second sample, not filtered till after five days, tasted intensely bitter, and grew worse on standing. The newly-formed yeast, at first of a whitish yellow, had taken a brownish color, died off, was precipitated by the more alcoholic character of the fluid, and formed with the alcohol in nascent state that substance which betrays itself by its bitterness in unhopped fermented liquors when the fermentation has been neglected. The compound in question is by no means innocuous. It was isolated by treating the liquor according to Dragendorff's methods I. and II. Langbeck succeeded in obtaining it in a crystalline form, and described its reactions. There is but little doubt that other products besides alcohol, carbonic acid, glycerine, and succinic acid are produced during the fermentation of worts, and some of these may materially modify and injure the flavor of the resulting beer; the use of chemically prepared sugars may tend to the production of these mysterious compounds, but at present our knowledge of the subject is very meager.—*Brewers' Guardian.*

A French Safety Lamp.

At the usual annual meeting of the Académie des Sciences, just held, the yearly prizes bestowed by the society in recompense of services to science have been awarded. Among others, M. Birckel, a civil engineer employed at the Pechelbronn mines, has received the Montyon prize—which is restricted to improvements in dangerous industries—for a modification of the Davy safety lamp. M. Birckel's improvement is very simple, consisting in providing the wire gauze cylinder with a double iron casing. The top case is movable, and slides over the under one, which is fixed, when a concentric movement is given to it by turning the hanging handle. These casings have corresponding openings of equal section, so that it is possible to more or less restrict the supply of air, or to shut it off altogether, and so instantly extinguish the gas burning inside the lamp when there is much light carbureted hydrogen in the atmosphere. It is not generally necessary to go so far as to extinguish the lamp by hand, because if the air supply be carefully regulated, any addition of combustible gas to the atmosphere will of itself cause extinction through lack of oxygen. M.

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Birckel's lamp has been used for nearly a year in the Pechelbronn mines, which are very fiery, without any accident having happened.

A Good Suggestion to Housekeepers.

No one knows until she has tried it, says an experienced housewife to one of our contemporaries, how much she may change the aspect of things about the house by using a little varnish. On a sunshiny day take the old chairs and tables out on the porch or by an open door, and, after thoroughly dusting and wiping off with a damp cloth, apply a thin coat of varnish, and so cover up scratches and marred spots of all kinds. It will dry in a very short time, and you will be surprised to see how much good you have done. A flannel cloth, with a very little linseed oil, is good to rub furniture with, but the greatest care must be exercised to prevent any oil being left on the wood to attract dust. It must be rubbed until you would not know, except by the improved appearance, that any oil had been used.

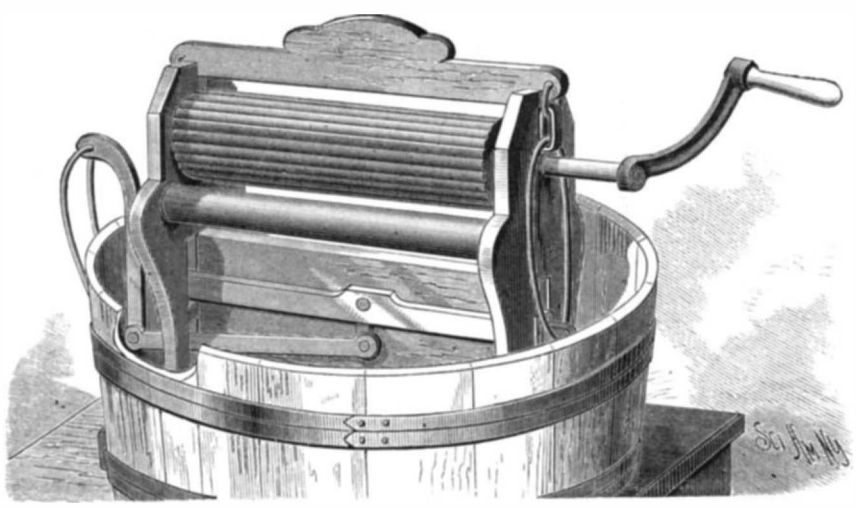
NOVEL WASHING MACHINE.

The washing machine shown in the annexed engraving employs a system of rods and levers by which the vessel and water in which the clothes are washed are made to produce the pressure necessary to cause sufficient friction for cleansing the goods, and insure a uniform pressure upon all thicknesses of material without the use of springs or complicated devices.

In machines of this class it has been the general practice to employ springs to produce the necessary pressure, and this is the principal reason why clothes washers have not come into more general use. Where springs are used the thicker the goods the greater the pressure and the more difficult it is to use the machine, but where the weight of the tub, water, and washing apparatus is employed the pressure is uniform on all thicknesses, and the work of washing with the machine becomes easy.

The washing machine, consists of three rollers mounted in a frame fixed to the bottom of the tub, two of the rollers having stationary bearings, while the third or upper one has movable bearings connected by straps with a cross bar beneath the lower rollers. This cross bar is connected by a link with a lever fulcrumed in the frame of the machine; the longer arm of the lever being connected with a standard rising from the bench.

The side of the tub opposite the standard is pivoted or hinged to admit of the oscillation of the tub as the rollers adapt themselves to clothes of different thicknesses. This invention was lately patented by Mr. J. K. Dugdale, of Richmond, Ind.



DUGDALE'S WASHING MACHINE.

Effects of Optical Slits.

M. Trève has lately described some curious effects. Looking through a fine slit at a vertical object (a post or a mast for instance), he finds the perception much more distinct when the slit is horizontal than when it is vertical. On the other hand, to distinguish horizontal lines more clearly, the slit must be held vertically. But if, in general, one look at a house or a landscape through a fine slit, it is found that the maximum of brightness of the horizon is when the slit is horizontal. This effect, it is said, is also produced with the solar and lunar disks; they are seen much more distinctly with the horizontal slit. M. Trève has reproduced the effect by photography, and the negatives taken with the horizontal slit were more distinct. The light appears to be propagated with more intensity through the latter than the former, the vertical bands of solar photographs showing well the interferences and passage of light through a vertical slit. Again, if a cross-slitted disk be held between the sun and white screen, the horizontal part of the cross on the screen is brighter than the vertical. The practical application of these experiments of M. Trève to photography would appear to be the relation which they bear to the shape of the apertures of diaphragms and to instantaneous shutters. Is it a fact with regard to the latter that the uncovering of the lens horizontally admits more light, and therefore produces a picture more quickly than a shutter which opens vertically? There may be no difference, but the point, at any rate, is worth deciding.—*Photographic News.*

Seaweed Jelly.

The seaweed, *Arachnoidiscus japonicus*, which is used by the Japanese and Chinese to pack porcelain and other articles for exportation, is said, by the *Journal of Applied Science*, to be made use of in France for the purpose of making a spurious fruit jelly. When placed in a tumbler of water it absorbs the water in a few minutes; then a number of shoots grow, and constitute a jelly nearly as transparent as the water from which it is made. The jelly is easily sweetened with glucose, and cochineal or other coloring matter is added with equal facility to imitate the color of the fruit. The perfume and the taste were the only real difficulties that remained to be overcome. After considerable study it was discovered that by using a mixture of certain ethers with tartaric acid, glycerine, etc., a perfect imitation of the odor of raspberries was produced. By putting a little of this essence to the seaweed which has been allowed to develop itself in water, a substance is obtained which has the consistency of fruit jelly, though no fruit has been used, which is sweet, though no sugar has been employed, and which has the color and fragrance of raspberries, though altogether destitute of that fruit. When this ceases to please, another very good fruit flavor is produced by treating castor oil with nitric acid. The jelly still retains a little of the fibrous nature of the plant, and has a tendency to split and fall to pieces, instead of forming adhesive lumps. Examined by the microscope, it has no resemblance to the jelly made from fruit. Then, as the jelly must be colored, it is easy enough to discover the presence of an artificial dye. Without resorting to the laboratory, it suffices to dissolve a little of the suspected jelly in some tepid water, and dip a white silk ribbon in the solution. If it is a natural jelly the ribbon will only be a little soiled; but if the jelly has been artificially colored the ribbon will also be colored.

ENGINEERING INVENTIONS.

Mr. William H. Birge, of Franklin, Pa., has patented an improved storage tank for petroleum, so constructed that the floating cover can never sink to the bottom of the tank, and so braced that it will stand all weather and wind storms without the necessity of an external roof or other inclosure. The floating cover is so constructed that it will serve the purpose of a roof and afford ready access to the interior of the tank, and also a partial roofing made in sections whereby the body of oil is protected from rain and from fire.

An improvement in connecting rods has been patented by Mr. Jacob J. Anthony, of Sharon Springs, N. Y. The object of this invention is to provide a lubricating connecting rod for cranks, crank pins, slides, or other parts of mechanism where connecting rods are used. It is composed of a straight tube forming an oil chamber, having a journal box secured on each end and communicating interiorly. The caps of the journal boxes are held in position by straps extending parallel with said tube and on either side of it.

Mr. Daniel Gallafent, of Woolwich, County of Kent, England, has patented an improved rotary engine, which may be driven by steam, compressed air, water, or gas, and which may be adapted for use as a pump, a water meter, a blower or exhauster, or as a hydraulic buffer for absorbing or destroying the recoil of heavy guns, or other purposes.

Mr. Robert H. Elsworth, of Bayonne, N. J., has patented an improved boat for transporting city sweepings and offal to sea and safely and quickly discharging them. The invention consists of a barge covered amidship for nearly its entire length with a peaked roof or deck that slopes downward on both sides from a central longitudinal line at an angle of about forty-five degrees to the side-rails of the boat; and it consists, further, of hollow or box guards extending along each side of the boat or barge above the water line, open at the top and provided at the bottom with doors that swing open downward, these doors being simultaneously operated by ropes or chains that are made fast to winches or other suitable devices, the intention being that the sweepings and garbage loaded on the sloping deck and in the guards shall be quickly discharged on either side of the barge by opening the guard doors, so that even in very shoal water the barge load may be discharged clear from the barge and without interfering with her movements.

IT is stated that the Bank of France has almost entirely abandoned chemical tests in favor of the camera for detecting forgeries. The sensitive plate not only proclaims forthwith the doing of the eraser or penknife, but frequently shows, under the bold figures of the forger, the sum originally borne by the check. So ready is the camera to detect ink marks that a *carte-de-visite* inclosed in a letter may to the eye appear without blemish, while a copy of it in the camera will probably exhibit traces of writing across the face, where it has merely been in contact with the written page.

IN a letter to *La Nature*, M. Cornillon states that when observing the sun lately with a telescope, he was struck with certain undulatory movements on the disk. On inquiry into their cause he is led to connect them with the wind blowing on the earth's surface at the time. They vary in intensity with this, and they have generally (but not always) the same direction as the wind. Where they have a different direction they indicate a change of weather, or at least the direction of the wind next day.

The Timber Line of Mountains.

Some very interesting facts were brought out at a meeting of the Academy of Natural Science of Philadelphia, concerning the timber line of mountains. The highest Alpine vegetation consists for the most part of short stemmed perennials. Lower down are found dwarfed trees of species, which, still further down the mountain sides, form forests of considerable height, and which, as trees suited to merchantable purposes, make what is known to mountain travelers as the timber lines. In the mountains of Colorado the forests commence at about 7,000 feet above sea level, and continue up to about 11,000 feet, when they suddenly cease. At this point the coniferous trees are from thirty to forty feet high, and above the same species exist as stunted shrubs, seldom exceeding three or four feet in height, and often but a foot, though trailing widely over the ground. In this dwarfed condition they are often found some 1,500 feet higher up, or half way from the recognized timber line to the top of the mountain. On Mount Washington, in New Hampshire, which is a little over 6,000 feet high, the timber runs up to about 4,000 feet, while Mount Webster, a mountain forming the southern peak of the same chain, and about 4,000 feet high, has little timber above 3,000 feet. Roan Mountain, in North Carolina, is about 6,300 feet above the level of the sea, and on some parts of it timber extends to its summit. At a height of 6,000 feet a black oak was measured that was five feet in circumference at three feet from the ground, and forty feet high.

The question as to the peculiar course of the timber line is a mooted one. Until recently it has been referred wholly to climatic conditions, of which temperature and moisture have been regarded as the chief elements in producing the result. The objection urged to this theory is that the dwarfed and gnarled cone-bearing species, extending so many hundred feet up the mountain sides, never produce seed, which leads to the alternative of believing that the seeds have been carried up the mountain sides in enormous quantities and to great distances from the fruiting trees below by winds, or else that there were seed-bearing progenitors of these scrubby trees, beneath the tall protecting branches of which they had their earliest stages of growth. The result of an examination of different parts of Mount Washington favors the latter supposition. As is generally known, there is a railway running straight up the mountain side from the base to the summit. Near the timber line a cut about ten feet deep had to be made through an area covered by mature balsam firs. Under the trees moss and dead roots and old fir leaves had made an earthy strata of a foot in depth. The moss was still green from the rains, melting snows, and fogs of this elevated region, and sustaining the various kinds of low vegetation common to such heights. Young firs were springing up in great abundance, but all the larger trees were dead, though here and there might be seen a branch with a few lingering green leaves. This mass of dead, standing timber occupied several acres, and the reasor of the death of the trees was evident. The cut showed that the forest stood on a mass of large but loose rock, through which the water from the mountain above rushed, carrying with it all the earthy matter on which the larger trees had subsisted, but leaving the tough, turfy matter at the surface, on which the smaller trees of the same sort may live for many years. With the death of the larger trees there is an increase of light, and then the grasses and sedges speedily take possession, holding together the loose soil and permitting, in many cases, an increase of the earthy layer by holding much of the disintegrated rock which washes down from above.

A careful examination of the patches of scrubby spruces above the timber line not infrequently shows dark patches of vegetable mould, evidently the remains of larger trees that have been growing, where now only the masses of small scrubby plants exist. In some places a sharp stick may be pushed down among the dwarf firs and spruces, and the mass of roots intermixed with earth found to be but a foot or so deep over the loose rock from which the earth has been wholly washed away. Again, there are some places, often nearly an acre in extent, where the scrubby firs are still standing, dead, from the earth having been washed away, not leaving enough for even the moderate demands of these small bushes.

It is evident that many of these dwarfed specimens are of a great age. Some that were examined were certainly fifty years old, though the stems at the ground were no thicker than a man's wrist, and, trailing on the ground, occupied but sixteen or twenty square feet of space.—*N. W. Lumberman.*

Large Locomotives.

The working of the experimental locomotive, "No. 10," lately tried, of the Pennsylvania Railroad, has been so satisfactory that ten more of the giants are to be built at the Altoona shops this summer. The driving wheels of the "No. 10" stand 6 feet 6 inches above the rails. It is said that ever since it was put upon the fast train between New York and Philadelphia, this engine has been making a mile in fifty-seven seconds on up grade with a long train in tow without getting heated. It makes more than a mile a min-

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ute and "keeps cool." Of course there is a great consumption of fuel. In 180 miles 12,000 pounds of coal are used up. The water tank contains 3,000 gallons, 400 more than is usually carried. Everything else is on a proportionately large scale. Only the delay in getting boilers sufficiently large has prevented the completion of two others of nearly the same pattern.

NOVEL CANDLESTICK.

The engraving shows a candlestick which has a candle receptacle formed of elastic fingers capable of fitting can-

NOVEL CANDLESTICK.

dles of different diameters, and it has a case for matches contained within a hollow pillar supporting the candle receptacle.

The hollow pillar bearing the candle receptacle is permanently fixed to a base plate, and the match case, which is entirely separate from the other parts, is introduced into the pillar through an opening in the base plate, and kept there by spring catches. It is readily removed to expose the matches.

This invention has been patented by Mr. M. Brassill, of Hartford, Conn.

NEW TELEPHONE TRANSMITTER.

We give an engraving of a new transmitting telephone, patented by Mr. E. Berliner, of Boston, Mass., and owned and made by the American Bell Telephone Company, of that city. Fig. 1 is a front view and Fig. 2 a perspective view showing internal parts.

The instrument is very simple and compact, and has the all important advantage of not being liable to disarrangement.

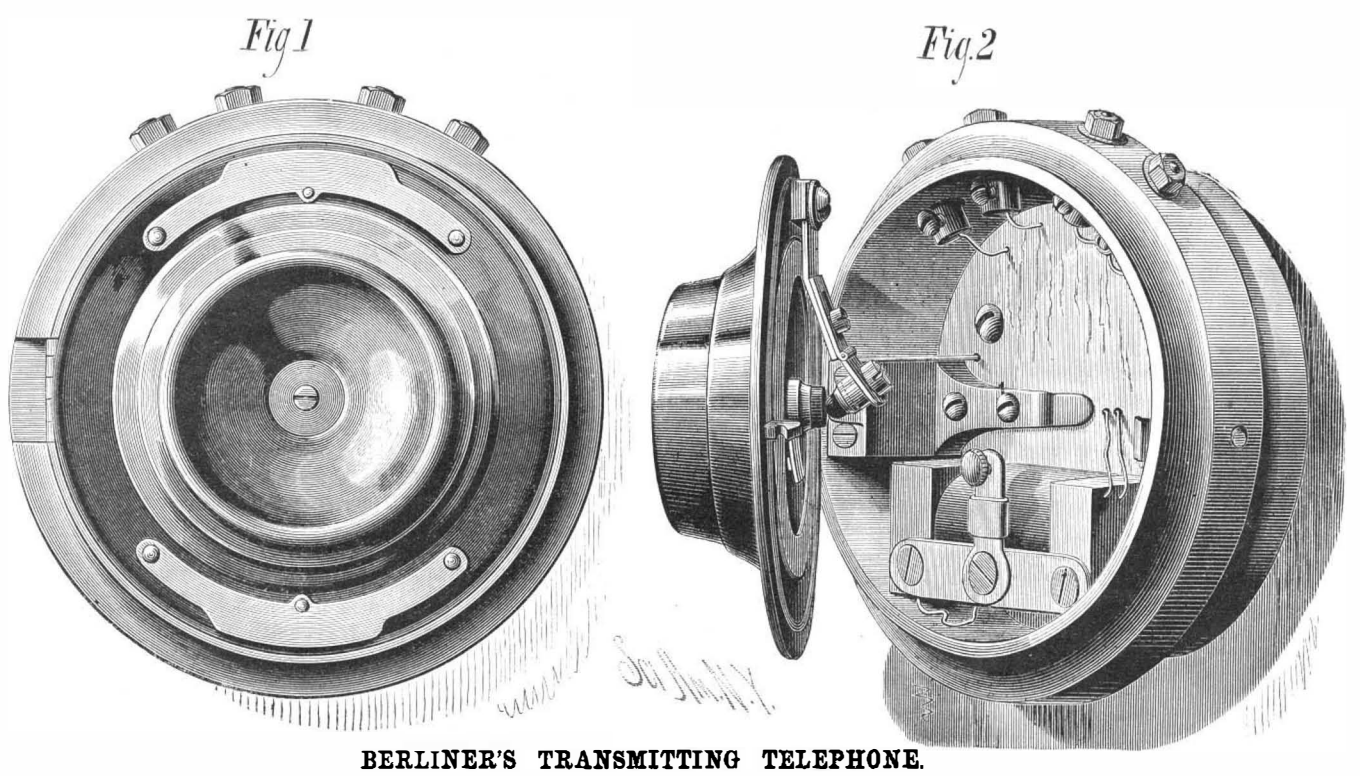
The principal feature of the invention is the disposition of the carbon contact surfaces, one being attached to the diaphragm, the other being supported by a metal socket attached to a hinged plate secured to an arm that projects from the back of the mouthpiece downward over the diaphragm. This arm serves the double purpose of supporting the free carbon electrode and clamping the diaphragm in its place against the back of the iron mouthpiece. The diaphragm is bound around the edges with soft rubber, and is separated from the mouthpiece by a ring of pasteboard. The iron mouthpiece is hinged to a casting fastened to the circular box which contains the induction coil and supports the binding screws for the battery, line, and ground wires. To the front of the induction coil is attached a plate connected with the battery wire, and carrying a spring having in its free end a screw which bears against a spring connected with the center of the diaphragm and acts as a dampener as well as a conductor, through which the current passes to the carbon electrode at the center of the diaphragm. The battery current enters at one of the binding screws, passes through the primary wire of the induction coil, through the spring and carbon electrode at the center of the diaphragm, through the hinged electrode, metallic mouthpiece and its hinge, and back through a binding screw to the battery.

The variation of the current in the primary circuit occurs at the contact of the two carbon electrodes, the contact being varied by the vibration of the electrode attached to the diaphragm.

When the transmitter is used for long distance telephony, the pendent carbon electrode is made heavier, to reduce resistance in the local current and to amplify the electrical undulations.

The terminals of the secondary wire of the induction coil are connected with the two remaining binding screws, which are connected, one with the ground and the other with the line, in the usual way.

The accessory devices connected with this transmitter may be of the usual character. It will operate well with any of the well known forms of receiver, and is easily managed and thoroughly efficient. This transmitter has been well introduced, and large numbers of them are being used in Europe. They have been adopted on several of the leading German railways, and are extensively used in the German postal service.



BERLINER'S TRANSMITTING TELEPHONE.

100,000 Buffalo Killed Last Winter.

It is estimated by competent authorities that 100,000 buffalo hides will be shipped out of the Yellowstone country this season. Two firms alone, says the *Sioux City Journal*, are negotiating for the transportation of 25,000 hides each. When to this is added the immense amount of skins and furs of other kinds—deer, elk, antelope, bear, beaver, etc.—some idea may be formed of the extent of the Yellowstone pelt and fur trade.

Most of our citizens saw the big load of buffalo hides that the C. K. Peck brought down last season, a load that hid everything about the boat below the hurricane deck roof. There were 10,000 hides in that load, and they were all brought out of the Yellowstone on one trip, and transferred to the C. K. Peck. How such a load could have been piled on the little Terry not even the men on the boat appear to know. It hid every part of the boat, barring only the pilot house and the smokestacks. But such a load will not be attempted again. For such boats as ply the Yellowstone there are at least fifteen full loads of buffalo hides and other pelts. Reckoning 1,000 hides to three car loads, and adding to this fifty cars for the other pelts, it will take at least three hundred and fifty box cars to carry this stupendous bulk of peltry East to market. These figures are not guesses, but estimates made by men whose business it is to know about the amount of hides and furs awaiting shipment.

Nothing like it has ever been known in the history of the fur trade. Last season the output of buffalo hides was above the average, and last year only about 30,000 hides came out of the Yellowstone country, or less than a third of what is there now awaiting shipment.

The past severe winter caused the buffalo to bunch themselves in a few valleys where there was pasturage, and there the slaughter went on all winter. There was no sport about it, simply shooting down the famine-tamed animals as cattle might be shot down in a barnyard.

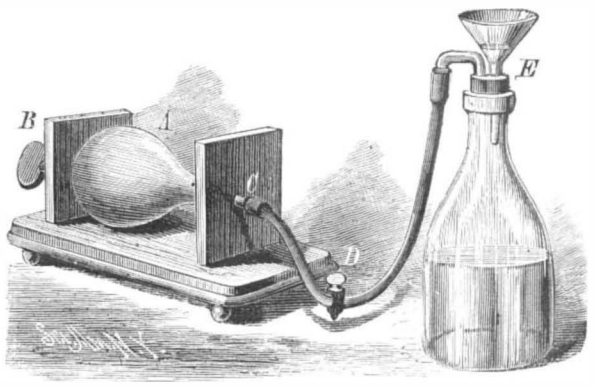
To the credit of the Indians it can be said that they killed no more than they could save the meat from. The greater part of the slaughter was done by white hunters, or butchers, rather, who followed the business of killing and skinning buffalo by the month, leaving the carcasses to rot. When the buffalo are all killed off, as they bid fair to be in a very few years at this rate, then everybody will wonder that the government did not do something to preserve this. the noblest of animal game, or at least prevent the killing of the buffalo for the hides alone.

A SIMPLE FILTER PUMP.

BY JOHN EITEL.

The engraving shows a simple device for accelerating the operation of filtering. It is intended to replace the Bunsen filter pump in many instances, and it consists of a collapsible rubber bulb, A, mounted between two standards and capable of being compressed by the thumbscrew, B. The mouth of the rubber bulb is connected with the filtering bottle by means of a flexible tube provided with a pinch cock, D. The filtering funnel is provided with a small platinum cone which prevents the filtering paper from being drawn downward with such force as to rupture it.

The exhaustion is effected by first expelling the air by turning the screw, B; the flexible tube is then connected and the screw retracted, to produce a partial vacuum. To ren-



A SIMPLE FILTER PUMP.

der the operation continuous the cock, D, is closed when it becomes necessary to again expel the air from the bulb.

The Uses of Mica.

The *Tradesman*, referring to the mica beds which have been recently discovered in East Tennessee, adds:

The mica chiefly met with in commerce is of that variety which is proof against acids and intense heat. Its toughness, elasticity, and close approach to transparency naturally led, at first, to its use for windows, and especially to its employment in lanterns. It is found in large quantities in North Carolina, where there are unmistakable evidences that some of the beds were worked a great many years ago. The finer sheets of tough mica are now used for such purposes as the dials of compasses, the lettering of fancy signs, covering photographs, constructing lamp shades, reflectors, etc. Of late, mica has been used in the soles of boots and shoes, as a protection against dampness. The invention consists of a sheet of mica embedded in thin coatings of cement and placed in the boot or shoe between the outer and inner sole, the upper leather lapping over its edges, and covering the upper space from the toe to the instep.

There are many other uses to which mica is put, and it is becoming more and more valuable as the arts and trades progress.

A Monster Cylinder.

There was cast at the Morgan Iron Works, in this city, the other day, what is said to be the largest steam cylinder ever cast. It is 16 feet 1½ inches long, 110 inches in diameter, and required for its casting 45 tons, or 90,000 pounds, of gun metal. It is intended to accommodate a piston stroke of 14 feet. The metal in the thinnest part is 1¾ inches thick, and the flanges at the top and bottom are 2⅝ inches thick by 5¾ inches wide. Under the top flange the cylinder has a belt 16 inches wide, another 6 inches wide above the bottom flange, and between these two, three more belts, each 6 inches in width. The thickness of the metal at the belts is 2⅛ inches. A nozzle for the upper steam chest is cast on the cylinder, with an opening 14½ by 63 inches, the metal on the top of this nozzle being 1¾ inches in thickness, and on the sides and bottom 1½ inches.

The casting of this massive piece of work was done in a mould constructed of brick, and lined with loam, the outside being covered with heavy iron plates to prevent the matrix from bursting when the molten metal was poured in. The mould is constructed of one cylinder of brick and loam within another, the space between them being the required thickness of the casting, the flanges, belts, and other parts

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of the work being accurately delineated in the matrix. Over half the mould was sunk in the solid earth which forms the flooring of the iron works. It required the metal three hours and twenty minutes to melt, and the 90,000 pounds were then transferred by the labor of 100 men to two huge tank ladles, each having a capacity of about 15 tons, and two large crane ladles. The tanks were connected with the mould by pipes, and the crane ladles were attached to huge cranes.

At 1 o'clock John Roach, who personally supervised the casting, gave the order to begin the pouring. The molten metal was turned into the mould from the two tanks on either side, and at the same time the two crane ladles were swung over, and from all four a red stream of liquid metal began to flow into the matrix. It took precisely two and a half minutes to complete the pouring and fill the mould. The operation was watched very attentively by Mr. Roach and his foreman, and when it was completed both pronounced the casting to have been successful.

The cylinder is intended for a new iron side-wheel steamer building for the Old Colony Steamboat Company, for the Long Island Sound.

THE LEMUR VARI.

Lemur is the name applied to many animals of the order *Quadrumana*, or monkeys, of the families *Galeopithecidæ* and *Lemuridæ*.

The fingers are not all provided with flat nails, some of them terminate in claws. They stand with difficulty, and their gait is generally like that of a quadruped. They have no pouches; their nostrils terminate in folded elastic sides, which permits of opening and closing them at pleasure. The incisor teeth are separated by vacant spaces, and the molars provided with sharp conical points adapted to tearing. The lemurs live principally upon fruits and roots, and are fond of insects; if they eat flesh at all it is in very small quantities. If the physical conformation of the lemur is similar to that of the carnivorous animals, their habits place them among the monkeys, and like them they live habitually upon the trees in the midst of the foliage. There, concealed and suspended by their lower members, they watch for their prey. If an insect comes within reach it is the work of an instant to catch and devour it.

The lemurs comprise five principal genera, almost all natives of the island of Madagascar or the adjacent countries. The *indri*, one of the largest species, are tamed by the natives of Madagascar, and being very agile are trained like dogs for the chase. The *loris* have no tails, a characteristic which distinguishes the other species. There are also *galagos*, *tarsiers*, and *makis;* these last are subdivided into many species: the *macoco*, the *mongoux*, and the *vari*. The animals represented in our engraving belong to the species *vari* of the genus *maki*. They are remarkable for their lank forms, their long bushy tails, the ruff around their faces, and their peculiar eyes, large and round, which give them the ghostly appearance to which they owe their name.

It is known that the Romans believed that lemurs were malevolent spirits who returned at night to the earth to torment the living, and that they instituted special ceremonies with the design of removing them. "Lemurs, gods of the infernal regions, come out of this abode." But one has never been tempted to address this objurgation to the lemur vari, notwithstanding his name and astonishing appearance, because he is gentle, sociable, fawning, and attaches himself quickly to persons who care for him and treat him well.—*L'Illustration.*

A New Species of Aphis Affecting the Pine.

Among our native forest trees, none, unless it is the oak, suffer more from the depredations of insect enemies than the pine. Distributed as it is—from the Arctic to the tropics—climatologically speaking, it becomes a prey to every conceivable form of insect life.

Already its enemies may be reckoned by hundreds; but notwithstanding this, hardly a year goes by without some careful investigator adding others to the list. It is not the intention of the writer to enter into full details or enumerate all of its foes, but to call the attention of entomologists to a new aphis affecting a pine in Florida, that has evidently been overlooked by others.

For the past two years we have detected numerous large brown plant lice upon the common pine of this region (*Pinus australis*), which for want of time we have left unmolested. They cluster together upon the new and tender branches, which they puncture with their remarkably long beaks, causing the sap to exude and the branch upon which they exist to become gummy and sticky. In their habits they are suprisingly shy and timid. On disturbing them they invariably seek safety by hiding between the needles of the pine; indeed, even on hearing approaching footsteps, we have observed them cling closer to the limb, while a few skelter off where the needles are denser.

In looking up literature on the subject, we find several species of aphides described and mentioned as existing upon pines, but none on *Pinus australis*, nor will any of the descriptions agree with the species under consideration. It belongs to the section *Lachnini*, as defined by Thomas, and we therefore propose for it the name of *Lachnus australi*.

* By Wm. H. Ashmead, of Jacksonville, Fla., in *Canadian Entomologist.*

The Spring Flower Trade.

The *Sunday News* has been making inquiries with respect to the spring flower trade of this city, and finds that it opened the second week in April, and will last until the beginning of June. A prominent florist estimates that three hundred wagon loads of flowering plants are brought to the city during the period of the spring trade, and that as much as $2,000,000 is spent every spring in New York and Brooklyn for plants and flowers.

The flowers come from all around New York. In New Jersey, Staten Island, Long Island, and the adjoining counties of this State are vast flower and plant farms, each of which represents a fortune to its owner. Over in Astoria one floriculturist has over two acres of ground under glass, and there are several others like him and many less extensive, but still very large growers. These raisers have each their special varieties and graftings of plants, and in addition to their New York trade, ship all over the country. San Francisco, Montreal, and Savannah are profitable markets to them, and in every town and city of the United States they have customers. In addition to these extensive culturists, who raise the rarest and costliest exotic plants, as well as the commonplace market flowers, there are many smaller ones, who raise flowers for the spring trade and the winter supply of the bouquet makers almost exclusively.

In addition to the big flower and plant farms at Flatbush, Astoria, Union Hill, and Orange, there are many minor ones scattered all over the suburbs, and even in the city itself. One popular one is in Fourteenth street near Third avenue, and another occupies the corner of Houston and Hudson streets. Within a radius of thirty miles from the City Hall, there is at least $10,000,000 invested in the business.

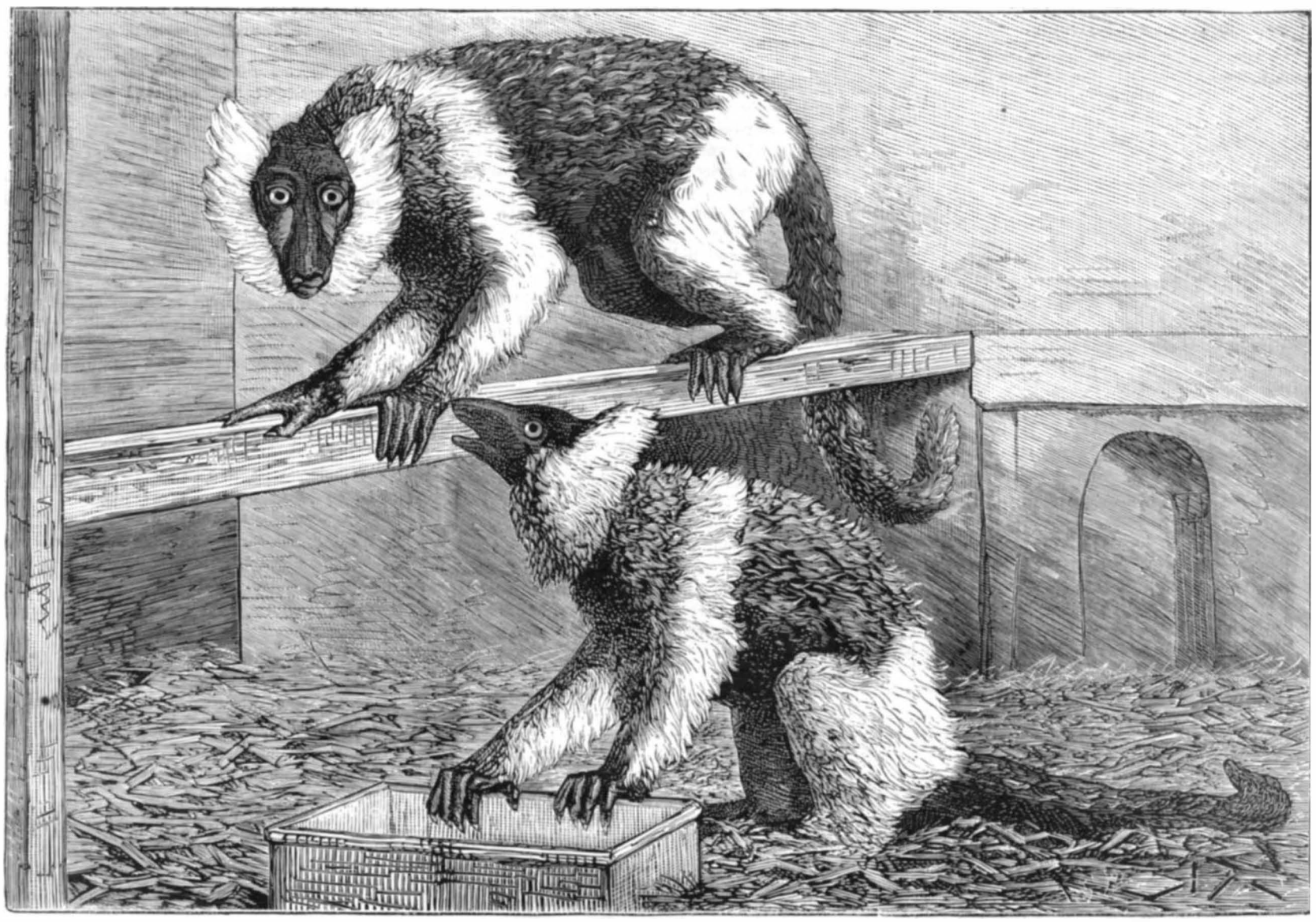
To enumerate the varieties of plants and flowers sold in the spring trade this year would require a census of the globe in that line. The gardeners are constantly adding foreign varieties to their stocks, and the gardens of India, China, and the Sandwich Islands contribute to the store New Yorkers select from. The heaviest sales are, of course, in the cheaper varieties of plants. The familiar roses, geraniums, fuchsias, heliotropes, pansies, daisies, hydrangeas, laburnums, verbenas, petunias, violets, carnations, and mignonettes are sold by the hundreds of thousands. Ivies, passion flowers, and other vines have an immense sale too. Ferns, native and tropical; strange grasses from the sun-smitten natural gardens of South America, and orchids from the mysterious forests of the Equator swell the list. The catalogues the flower men publish would put those of many a library to shame, for size at least.

A dealer said that the largest profit is made on cheap plants, the number of them sold is so great. The heavier gains are made by the owners of city greenhouses, who raise fine plants, and are able to sell them without the intervention of middlemen.

The trade in flower and vegetable seeds at this season almost rivals that in plants and flowers. The flower seeds are largely imported from France and Germany, a few coming from England and Holland. The vegetable seeds, on the contrary, are grown in the New England States, New York, Canada, and other sections of the continent, and are exported so as to almost balance the imports of flower seeds. American vegetable seeds are much better than those grown in Europe and produce better results. They are popular abroad in consequence.

Silk Culture in Louisiana.

Efforts are being made in Louisiana to attract to that State the silk growers of Provence, whose prospects in France have been blighted by plagues affecting grape vines and silk



THE LEMUR VARI.

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worms. Specially promising are the opportunities held out in connection with silk growing. One of the better known silk growers of Louisiana, Mr. L. S. Crozier, says that not only are the silk worms of that State entirely free from disease, but the mulberry grows so rapidly that, instead of waiting five years for the first crop of cocoons, the careful planter can begin to feed worms the first year after planting.

The prospects for this spring's hatching are said to be very encouraging. The frosts of the past winter did not hurt the trees, and the worms are doing nicely. Some are nearing the last moult, and others are yet not hatched. All are healthy. One good tree will feed enough worms to produce seven pounds of silk, and ten pounds of leaves will produce one pound of silk. One ounce of good eggs will produce enough worms to eat 1,200 pounds of leaves. They cost from 50 cents to $6 per ounce. Thus, at $5 per pound for silk, the allowance for labor and expense is very large. The secrets of silk culture are pure air, warmth, dryness, and proper food. That the climate is warm enough in Louisiana is proved by the fact that a lot of 1,500 silk worm eggs were wintered at the outside temperature by Mrs. Leywaud, and are now hatched. The mulberry tree flourishes and the workers are careful. When it is wet they keep a fire in the house of the silk worms, and dry the leaves on the branches cut from the tree before they spread them on the worms. They avoid the dew, and it is a rule to have two meals of leaves in advance. The State, it is believed, has great advantages over European countries in the matter of raising the mulberry.

Silk Culture in Pennsylvania.

The Pennsylvania House of Representatives lately gave a hearing to the Women's Silk Culture Association touching the aims of the association. Mrs. John Lucas, president of the association, said that its main object was to instruct the women and children of the working classes in the management of silk worms and the proper treatment of the cocoons for the production of silk, by means of which they would be provided with light, agreeable, and remunerative employment. The advantages presented by this country for silk culture were enlarged upon, as well as the great benefit that would accrue to all classes of society by the proper encouragement and development of the silk industry. Several other lady officers of the association discussed the purposes, methods, and prospects of silk culture, hoping to give the legislators such a favorable impression of the operations of the society as to secure a small appropriation for the enlargement of the work. At the conclusion of the addresses the members examined the specimens of cocoons which the ladies had with them, one case of which was raised by Mrs. Taylor, mother of the late Bayard Taylor, who is eighty years of age.

Photometry by the Photographic Method.

It is announced that M. Janssen has made a promising advance in the application of photometrical methods to the precise measurement of the intensity of light, the process adopted being equally applicable to strong or feeble light, and needing only the presence of one light source at the time of measurement. M. Janssen's photometer consists essentially of a frame with a sensitized plate, before which, and in the path of the light rays to be measured, a perforated screen is caused to pass with a known rate of uniform motion. If the perforations were rectangular, in the form of slits, a uniform shade would be produced on the plate; but, by making them triangular, a variation of shade is obtained, decreasing in depth from the side corresponding to the base of the triangles to that corresponding to the apex. To compare two luminous sources with each other, each source is made to act successively on two similarly prepared plates in the instrument, when the points of equal shade in the two plates indicate the ratio of intensity. There is no difficulty in obtaining and testing by the same instrument the exact ratio of sensibility between any number of plates, so that absolute reliability may be placed upon the equality of the conditions under which the tests are made. It is stated that this photometer is so delicate, and at the same time capable of such universal application, that M. Janssen has succeeded in comparing the light of the sun with that of various stars, and has compiled a table to express the illuminating power of the latter in terms of the former. In this way it is expected that a definite solar scale might be constructed, to which all artificial lights might be referred.

A New Process of Decorative Printing.

In a recent letter from Italy to the *Times* Mr. James Jackson Jarves says that a good deal of interest is being shown in Florence in regard to a new process of printing on satin for decorative screens, panels, hangings, etc. The process is the invention of a Signor Gutman, whose subjects are chiefly the brightest-hued birds and flowers, amid tropical foliage, ferns, and other graceful plants. They are skillfully done, Mr. Jarves says, and very striking on first appearance, but altogether too gaudy in general effect and lacking harmonious combination of colors. They would be painful to the eye to look at long, and would kill everything else in the room as to tints, producing intensely disagreeable discords of coloring. Yet, judging from the remarks of the press, it would seem as if this new system of decorative work would soon become all the fashion in Florence. The Orientals, and especially the Japanese, understand how to combine brilliancy with harmony in ornamentation, giving variety and animation to objects without violating those principles of æsthetic repose which are the alpha and omega of decorative art. Instead of this, in these works we have exaggerated garish compounds and contrasts, irritating to the senses and destructive to good taste. As the process is patented, no doubt cheap reproductions, done in a mechanical way, will soon be seen in America.

The Coarser Varieties of Timber.

An eminent philosopher, passing through a low attic upon one occasion, carried his head so loftily as to strike the collar beams which strengthened the rafters, whereupon a friend, who was with him, remarked that he who looked too high would not only run the risk of breaking his head, but would lose sight of a vast amount of beauty, which could be found only upon a lower level. That this truth applies to the experiences of every-day life is shown in the tendency of human nature to search for gold and diamonds because of a supposed superior reputation and value, leaving to the plodder and economist the task of looking for the baser metals of greater economic value. This truth applies with equal force to the searchers after wealth in the forest productions of the United States. The pine and the oak, together with black walnut and maple, have been the gold toward which the lumberman has turned his eager eyes, and they have turned his vision away from the humbler, yet not less valuable, sources of forest wealth which exist in the hemlock, black ash, and beech, with which our forests abound.

In one of the timber growing States, there is now an estimated wealth of $87,500,000 in the growing pine timber, estimated at an average value of $2.50 per thousand feet for the standing tree. This is a vast source of wealth to the State in which it is growing, yet in the same State, unhonored and most lightly esteemed, even to such extent that its wanton destruction passes unnoticed. are to be found fully 7,000,000,000 feet of hemlock, which, in the near future, will be sought for at a price scarcely below the present value of the pine, for which it will be utilized as a most excellent substitute in many of the coarser uses of lumber. This hemlock is to-day utilized only in the production of bark for tanning purposes, and it bears to the timber wealth of the State only about the same relation that the hordes of buffalo upon our Western plains bear to the meat supply of our nation, as they are slaughtered by the thousand and stripped of their pelts for the use of the civilized world, while the carcass is left to the vulture, regardless of the fact that a race is being exterminated which can never again be propagated. The hemlock tree of the Northwest, like the buffalo of the plains, possesses a value, the extent of which will be realized only after the process of wasteful extermination has done its worst and no more remains to be utilized. The hemlock in one State, if placed at a value which it will bear before the expiration of five years from this date, would bring to its owners not less than $14,000,000; at the value which is placed upon it to-day it is worth not less than $2,000,000, and, in the endeavor to utilize the bark, the trunk of the tree, which might also add to the wealth of its owner, is left to rot upon the ground or to feed the insatiate forest fires which sweep away so much of our forest wealth every year.

But another despised factor presents yet more astounding revelations of timber wealth. Thousands upon thousands of acres of hardwood timber are yearly destroyed in the clearing of land for farms and the burning up of the forest growths which they contain. The hardwood of the State in question, if valued at but 25 cents per cord, is of the value of $175,000,000, or twice as much as the value of the pine timber. And yet but little account, comparatively, is made of this vast source of wealth. The furniture factories of a mighty nation, the vast commercial industries of the world, are ready and willing to pay the gold for this timber, which, to a great extent, is suited to their needs: yet its owners fail to see the opportunity, and large quantities of valuable timber are consigned to the flames. The time is near at hand when a wiser policy must and will prevail, and the modest yet valuable timber growths now neglected for the more pretentious and popular pine, will receive the attention which they merit; and those who now esteem the gold mines more highly than they do the iron, will discover that in the latter is a more enduring source of wealth, toward which they will gladly turn while seeking the high road to prosperity.

The proneness of the human mind toward entering those avenues which give promise of sudden wealth is too well known to need comment. The land of gold will attract thousands; the discovery of iron excites hardly the slightest comment. Yet the iron is actually the more valuable in its adaptation to the wants of man, and in its ulterior effect in adding to his wealth. The careful, earnest, saving plodder of 25 years ago is the rich man of to-day, while the sons of his millionaire employer of the former time are his clerks, his porters, and his draymen. That which is common in every-day experience is neglected by the multitude in the mad rush after wealth, but the sons of the rag-picker and scavenger of to-day will perhaps be the merchant princes of the next generation, the foundation for their immense wealth being based upon the humble and despised occupation which by the multitude is neglected. These truths of every-day experience apply to the now neglected timber wealth of this country, and a wise conservation of the despised hemlock and hardwood growths of our forests will result in the accumulations of wealth far greater in extent than are the colossal fortunes which have been made by the operators in pine timber and lumber.—*Northwestern Lumberman.*

The Drawing Out of Glass Tubes.

The Bunsen blast lamp is generally used in the accomplishment of this object, although in case of necessity the common Bunsen burner, or a round compound burner, may be employed, taking care, however, to observe the previously mentioned precautions. The tube should be held between the first three fingers of each hand, in the flame, and continually turned until it becomes sufficiently soft as to bend easily; it is then quickly taken out of the flame and drawn out, the rotary motion being kept up. The axes of the two drawn out portions must be held in a straight line, otherwise sharp points will be obtained. Very much depends on the care with which the tube has been softened; when thick tubes are used, they should be turned with great regularity. The object of this turning is to avoid uneven softening; the lower portion of the flame is, of course, hotter than the upper portion, and so when the tube is drawn out, the lower portion being softer, would yield first, and the result would be an uneven drawing out. When the tube has completely cooled, the drawn out portion is cut at the desired point with a sharp glass knife. Then taking a file, the projecting points are filed off, and the opening may be narrowed as desired by melting the cut in the flame. Here, also, we must carefully and regularly rotate the tube in the flame, or else the end will bend of its own weight. If the orifice has become too small from having been held too long in the flame, or if it has closed altogether, it may be opened by carefully touching the cut with the flat side of a file; of course only after the tube has been completely cooled. In fact, for many purposes this latter method is considered desirable, especially when a gas, such as hydrogen, is to be burned from the end.

The advantage of this process is that the thin sides of the tube are thickened by the fusing, and so are better able to resist the heat produced by the burning gas. The fusing of the point of the tube is sometimes prevented by platinizing it. This is effected by dipping it into a solution of platinum chloride, so that a drop or two of the fluid adheres to the tube. The point, in heating, acquires a fine metallic luster. By repeating this operation several times, a good coating of metallic platinum will be produced both on the exterior and the interior of the tube. This method is recommended in connection with the development of arseniureted hydrogen gas in the Marsh test for arsenic. When a point is desired having a very small opening, it is considered advisable to first fuse the ends and then open them with a file to the required size.—*M. B., in Journal of Education.*

Annual Meeting of the Women's Silk Culture Association.

The Women's Silk Culture Association lately celebrated in Philadelphia its first anniversary, and was able to give an encouraging report of its first year's operations. Touching the financial aspects of the industry the report was decidedly hopeful.

"The demand for the raw material, its constant increase, its value to our country, has already been proven. There is another valuable item of wealth. The ready market is at our doors; a price has been offered for all pierced cocoons, formerly waste, to be used with approved machinery in the manufacture of spun silk. As soon as the American people prove that they are ready to raise cocoons the filatures of the country will be put into operation. Cocoons are worth a price ranging from $1.50 to $2.50 per pound, pierced cocoons at $1.80 per pound, and eggs from $4 to $5 per ounce."

Further on the report said: "Up to this date trees and cuttings, in quantities from five to hundreds, have been sent into fifteen different States, and eggs, to the amount of many ounces, sent into twenty different States. This is a beginning at least, and these experiments will lead to others, until the hope is all our States and counties will soon present at their annual fairs, among other agricultural products, their quota of *cocoons and silk.* This year has gained for us new hopes, new ideas, fresh knowledge, familiarity with the need of the people and the needs of the association, and last, but not least, we hope, new friends."

After the reading of the reports the following important communication was received:

"*Mrs. John Lucas, President Silk Culture Association.*

"MADAM: In order to encourage the culture of silk among the people directly tributary to Philadelphia, we will offer through your society a series of prizes for the best four pounds of silk cocoons raised in the States of Pennsylvania, New Jersey, Delaware, and Maryland, the awards to be made according to the judgment of a person or persons selected by the society.

"We propose to give $500 in premiums, as follows: $200 for the best pound of cocoons, $150 for the next best, $100 for the third in quality, and $50 for the fourth. We desire the society to arrange all the preliminaries, and the only active part we wish to take would be to pay over the money to the winners of the prizes.

"Yours respectfully,

"STRAWBRIDGE & CLOTHIER."

The Silk Culture Association is to select the judges, who will decide upon the cocoons when they are offered in competition.

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The Dark Day in Canada.

In some interesting and graphic reminiscences of Montreal sixty years ago, Mr. J. H. Dorwin writes to the Montreal *Star* as follows:

"What was the strangest occurrence of that time, or rather the strangest thing that ever happened in the history of this country, was what has been always known as the 'Phenomenon of 1819.' On the morning of Sunday, November 8, 1819, the sun rose upon a cloudy sky, which assumed, as the light grew upon it, a strange greenish tint, varying in places to an inky blackness. After a short time the whole sky became terribly dark, dense black clouds filling the atmosphere, and there followed a heavy shower of rain, which appeared to be something of the nature of soapsuds, and was found to have deposited after settling a substance in all its qualities resembling soot. Late in the afternoon the sky cleared to its natural aspect, and the next day was fine and frosty. On the morning of Tuesday, the 10th, heavy clouds again covered the sky, and changed rapidly from a deep green to a pitchy black, and the sun, when occasionally seen through them, was sometimes of a dark brown or an unearthly yellow color, and again bright orange, and even blood red. The clouds constantly deepened in color and density, and later on a heavy vapor seemed to descend to the earth, and the day became almost as dark as night, the gloom increasing and diminishing most fitfully. At noon lights had to be burned in the court-house, the banks, and public offices of the city. Everybody was more or less alarmed, and many were the conjectures as to the cause of the remarkable occurrence. The more sensible thought that immense woods or prairies were on fire somewhere to the west; others said that a great volcano must have broken out in the Province; still others asserted that our mountain was an extinct crater about to resume operations and to make of the city a second Pompeii; the superstitious quoted an old Indian prophecy that one day the Island of Montreal was to be destroyed by an earthquake, and some even cried that the world was about to come to an end.

"About the middle of the afternoon a great body of clouds seemed to rush suddenly over the city, and the darkness became that of night. A pause and hush for a moment or two succeeded, and then one of the most glaring flashes of lightning ever beheld flamed over the country, accompanied by a clap of thunder which seemed to shake the city to its foundations. Another pause followed, and then came a light shower of rain of the same soapy and sooty nature as that of two days before. After that it appeared to grow brighter, but an hour later it was as dark as ever. Another rush of clouds came, and another vivid flash of lightning, which was seen to strike the spire of the old French parish church and to play curiously about the large iron cross at its summit before descending to the ground. A moment later came the climax of the day. Every bell in the city suddenly rang out the alarm of fire, and the affrighted citizens rushed out from their houses into the streets and made their way in the gloom toward the church, until Place d'Armes was crowded with people, their nerves all unstrung by the awful events of the day, gazing at, but scarcely daring to approach the strange sight before them. The sky above and around was as black as ink, but right in one spot in mid-air above them was the summit of the spire, with the lightning playing about it shining like a sun. Directly the great iron cross, together with the ball at its foot, fell to the ground with a crash, and was shivered to pieces. But the darkest hour comes just before the dawn. The glow above gradually subsided and died out, the people grew less fearful and returned to their homes, the real night came on, and when next morning dawned everything was bright and clear, and the world was as natural as before. The phenomenon was noticed in a greater or less degree from Quebec to Kingston, and far into the States, but Montreal seemed its center. It has never yet been explained."

Wandering Needles.

The London *Lancet* observes that the vagaries of needles which have been introduced in the body, and have escaped immediate removal, have in all ages attracted the attention of collectors of the marvelous in medicine. Hildanus related an instance of a woman who swallowed several pins and passed them six years afterward; but a more remarkable instance of prolonged detention was recorded by Stephenson, of Detroit—that of a lady, aged seventy-five, who last year passed by the urethra, after some months' symptoms of vesical irritation, a pin which she had swallowed while picking her teeth with it in the year 1835—forty-two years previously. Occasional pain in the throat was the immediate symptom, but in 1845 she was seized with severe gastric pain, which passed away, and she had no symptoms until hæmaturia in 1876. This curious tolerance of such foreign bodies exhibited by the tissues is often observed in lunatic asylums. M. Silvy recorded some years ago the case of a woman who had a penchant for pins and needles so strong that she made them, in effect, part of her daily diet, and after her death 1,400 or 1,500 were removed from various parts of the body.

Another case almost as striking has been recorded by Dr. Gillette—that of a girl in whom, from time to time, needles were found beneath the skin, which they perforated, and were removed by the fingers or forceps. Concerning the way in which they had got into her system no information could be extracted from her. She was carefully watched, and in the course of eighteen months no less than 320 needles were extracted, all being of the same size. Most were black and oxidized, but some had retained their polish. The majority were unbroken. They passed out of various parts of the body above the diaphragm at regular intervals, but in a sort of series and always in the same direction. The largest number which escaped in a single day was 61. A curious phenomenon preceded the escape of each needle. For some hours the pain was evere, and there was considerable fever. She then felt a sharp pain, like lightning in the tissues, and on looking at the place at which this pain had been felt, the head of the needle was generally found projecting. The needles invariably came out head foremost. No bleeding was occasioned, and not the least trace of inflammation followed. The doctor in attendance extracted 318. They were sometimes held firmly, and seemed to be contained in a sort of indurated canal. It was conjectured that they had been swallowed with suicidal intentions; but, on the other hand, the way in which the needles escaped in series, and their direction with the head outwards, suggested that they had been introduced through the skin.

That little weight is to be attached to the pace at which the needles escape as proof of their mode of introduction is evident from a case recorded by Villars, of a girl who swallowed a large number of pins and needles, and two years afterward, during a period of nine months, 200 passed out of the hand, arm, axilla, side of thorax, abdomen, and thigh, all on the left side. The pins, curiously, escaped more readily and with less pain than the needles. Many years ago a case was recorded by Dr. Otto, of Copenhagen, in which 495 needles passed through the skin of a hysterical girl, who had probably swallowed them during a hysterical paroxysm; but these all emerged in the regions below the level of the diaphragm, and were collected in groups, which gave rise to inflammatory swellings of some size. One of these contained 100 needles. Quite recently Dr. Bigger described before the Society of Surgery of Dublin a case in which more than 300 needles were removed from the body of a woman who died in consequence of their presence. It is very remarkable in how few cases the needles were the cause of death, and how slight an interference with function their presence and movement cause. From time to time their detection by a magnetic needle is proposed as a novelty; but, as Dr. Gillette reminds us, this method was employed by Smee nearly forty years ago, and has often been adopted since.

Coca (*Erythroxylon coca*).

In Mr. Markham's "Peruvian Barks," recently published, he has given the results of his own observations, and collated that of other travelers, respecting this substance, and to this account we are chiefly indebted for the following facts:

"Coca," the "beloved narcotic of the Peruvian Indian," was first named botanically through the labors of Joseph de Jussieu. The history of this noted botanist is a melancholy one. He left France in 1735, in the ever memorable expedition of La Condamine, and after M. La Condamine left South America, M. Jussieu continued his botanical researches, making numerous journeys on foot, notably those to the cinchona regions. The results of fifteen years' labors were contained in certain cases of dried plants, etc., and a native servant at Buenos Ayres, thinking these cases contained money, stole them, and this loss had such an effect on poor Jussieu that he returned to France in 1771 deprived of reason.

The coca is the great source of comfort and enjoyment to the Peruvian Indian. It is to him what the kava-kava is to the South Sea Islander, the betel to the Hindoo and Malay, and tobacco to the rest of mankind, but with this difference, it produces invigorating effects. The Peruvian Indian looks upon coca with veneration. In the palmy days of the Uncas or Yncas, coca was sacrificed to the sun, the high priest or Huillac Umu chewed it during the ceremony, and before the arrival of the Spaniards, coca was used in lieu of money. After the Spanish conquest, much was done to prescribe its use, because as a council of bishops held in 1569, said it was a "useless and pernicious leaf, and on account of the belief stated to be entertained by the Indians, that the habit of chewing coca gave them strength, which is an illusion of the devil." Coca, indeed, from its popularity, being used by about eight millions of people, has always had a great commercial importance, and one viceroy, Don Francisco Toledo, issued no less than seventy ordinances concerning coca in the space of four years (1570–1574).

The coca plant is a shrub of four to six feet high, with straight and alternate branches and leaves like those of the tea plant, and is cultivated at elevations of from 5,000 to 6,000 feet above the level of the sea in the warm valleys of the eastern slopes of the Andes. Here the only alternations of climate is from wet to dry, frost is unknown, and it rains more or less every month of the year. The seeds are sown on the surface of the soil as soon as the rainy season commences, and begin to sprout in a fortnight, being carefully watered, and protected from the sun by a thatched roof. The following year the seedlings are transplanted in a soil carefully broken up and freed from weeds. The ancient custom was to raise the plants in terraces on the hillsides, but now plantations on the level ground are resorted to, although Indians aver that plants raised under the former conditions yield a much superior quality of leaf. At the end of eighteen months the first harvest is ready, and the picking of the leaves, performed by women and children, is very carefully proceeded with, so as not to injure the young and still tender shoots. As soon as one crop of leaves is removed, if well watered, and the ground carefully weeded, another crop is ready in about forty days. A plant continues to yield for about forty years, and Dr. Poeppig gives the profit of a coca plantation as about 45 per cent. Each picker carries a piece of cloth, in which the leaves, plucked one by one, are placed. These leaves are then taken to the drying yard, formed of slate flags. Here the leaves are spread out in thin layers, and carefully dried in the sun. Too much exposure to the sun spoils the flavor of the leaf, and if heaped too much together, the leaves ferment and become fetid. As soon as dried, the leaves are packed in bags made of banana leaves, with an outside covering of cloth, or packed tightly in larger parcels of about 50 lb. each.

In the Sandia district of Caravaya, two varieties of coca are recognized, the Ypara and the Hatun Yunca, the latter having a larger leaf than the former.

In Bolivia, coca is treated as a government monopoly, and the right is generally farmed out. In 1850, coca brought into that country's exchequer a sum of $200,000. The whole yield of coca in South America is estimated at thirty millions of pounds. Coca soon deteriorates in keeping, and Indians treat it as valueless if kept longer than seven months.

Such is the faith in coca, that it is believed if a dying man can but taste a coca leaf when placed on his tongue, his future bliss is assured. No Indian is without his *cuspa* or coca bag made of llama cloth, and three times a day, sitting down, he takes leaf by leaf and rolls them up in his mouth till he forms a ball. Then applying a small quantity of powder consisting of carbonate of potash, made by burning the stalks of the quinoa plant, mixed with lime and water, he goes on his way rejoicing. The use of coca is widely spread. The shepherd on the cold slopes of the Andes has but this and a little maize as his sole nourishment, and the runner messenger looks to it as his solace and support. As to the properties of coca, it seems very evident that it allows of a greater amount of fatigue, with a lesser amount of nourishment, and prevents difficulty of respiration in ascending steep mountain slopes. It has an agreeable and aromatic taste, accompanied by a slight irritation, which excites the flow of the saliva. When made into a tea, in taste it is like that of green tea, and effectually prevents drowsiness. Applied externally as a poultice, it moderates rheumatic pains, brought on by exposure to cold and wet, and also cures headache.

Mr. Markham chewed coca leaf very frequently, and states that he found it to produce an agreeable soothing feeling, that he could endure longer abstinence from food with less inconvenience, and that when using it, he could ascend precipitous mountain sides with a feeling of lightness and elasticity, and without losing breath. He also considers it the least injurious of all other like substances, even when taken in excess, and at the same time the most soothing and invigorating.

The Wax Palm in Pernambuco.

The Camanba palm (*Copernicia chifera*) seems to be a much more important plant in some parts of Brazil than is generally supposed. In Pernambuco the plant is very abundant, and the uses to which it is put very numerous. The wood, for instance, is used for roofing, both as beams or rafters, and as laths upon which to support the tiles; the fruits are used for feeding cattle, and the leaves are used for making hats and mats. A valuable medicine is obtained from the roots, which has recently been brought to notice in this country. From the shoots or leaves a wax is obtained; for this purpose they are cut before they unfold, dried in the sun, powdered, and boiled, the wax rising to the surface of the water. This wax, it is stated, is not produced in anything like the quantity that it might be. It is shown, in a recent report of Her Majesty's Consul at Pernambuco, that the export of this wax during 1875–76 amounted to 18,668 kilos, valued at £758; in 1876–77, to 171,980 kilos, valued at £6,957; in 1877–78 it fell to 89,482 kilos, of the value of £3,168; and in 1878–79, to 1,542 kilos, valued at only £61. By far the largest portion of this wax finds its way to this country. It is shown that the decrease during the last year was due to the famine and drought which so severely crippled all industry in the province. It is not a little remarkable that, at a time when roasted date stones are proposed as a substitute for coffee, we should also learn that the stones or seeds of the Camanba palm, when roasted, are used in Pernambuco as coffee.

Sleep and Sleeplessness.

Dr. J. M. Granville, in his work on this subject, says, with reference to the difficulty some persons find in getting to sleep: "Habit greatly helps the performance of the initial act, and the cultivation of a habit of going to sleep in a particular way, at a particular time, will do more to procure regular and healthy sleep than any other artifice. The formation of the habit is, in fact, the creation or development of a special center, or combination, in the nervous system, which will henceforward produce sleep as a natural rhythmical process. If this were more generally recognized, persons who suffer from sleeplessness of the sort which consists in simply being 'unable to go to sleep,' would set themselves resolutely to form such a habit. It is necessary that the training should be explicit and include attention to details. It is not very important what a person does with the intention of going to sleep, but he should do precisely the same thing, in the same way, at the same time, and under as nearly as possible the same conditions, night after night for a considerable period, say three or four weeks at least."

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion, about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sequeira Water Meter, see adv. on page 316.

Patent for sale. G. Neu, 191 W. Liberty St., Cin., O.

It never fails to give relief to the lungs, is what is said of Van Beil's "Rye and Rock."

Relief from the worst of aches, Use German Corn Remover. It never fails. Sold by all druggists. 25 cts.

Upright Self-feeding Hand Drilling Machine. Excellent construction. Pratt & Whitney Co., Hartford, Conn.

For Sale.—Screw Cutting Lathe. 36 in. x 18 ft.; New Haven make; good order. E. N. Brown, Pokeepsie, N.Y.

Punching Presses and Shears for Metal-workers. Power Drill Presses, $25 upward. Power and Foot Lathes. Low Prices. Peerless Punch and Shear Co., 115 S. Liberty St., N. Y.

Your boiler is predisposed to weakness by thickening of the water or burning of the iron caused by impurities in feed water. They should be removed by Hotchkiss Mechanical Boiler Cleaner. 84 John St., N Y.

The price of Boomer & Boschert's Cider Press is so reasonable that every fruit grower in the country can afford one. They produce more cider from the same quantity of apples than any other press. Illustrated circulars mailed free. New York Office, 15 Park Row.

Books on Practical Science. Catalogues free. Pocket Book of Alphabets, 20 cts. Workshop Receipts; a reliable handbook for manufacturers. $2, mail free. E. & F. N. Spon, 446 Broome St., N. Y.

Why suffer? German Corn Remover warranted to cure. Sold by all druggists. 25 cts.

Wanted.—An old established machinery firm on Cortland street would be pleased to represent, in New York city, a firm or company manufacturing a variety of Engines, Boilers, etc. Address Engine, Box 773, New York.

For Sale.—No. 1 22½ inch 8 roll (Schenck) Planer and Matcher, with undercutter, in perfect order. Belcher & Bagnall, 40 Cortland St., N. Y.

For Sale.—A Valuable Patent for Photographers' use, or can be manufactured on royalty. Address G. W. Baker, Wilmington, Del.

Propellers, 10 to 26 in. Geo. F. Shedd, Waltham, Mass.

Gardiner's Pat. Belt Clamp. See illus. adv., p. 284.

Essay on Inventions.—What qualities will make them profitable, and how to incorporate these qualities in inventions. 25 cts. postpaid. Address N. Davenport, Valparaiso, Ind.

Improved Skinner Portable Engines. Erie, Pa.

"Rival" Steam Pumps for Hot or Cold Water; $32 and upward. The John H. McGowan Co., Cincinnati, O.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

The Newell Universal Mill Co., Office 34 Cortlandt St., New York, are manufacturers of the Newell Universal Grinder for crushing ores and grinding phosphates, bone, plaster, dyewoods, and all gummy and sticky substances. Circulars and prices forwarded upon request.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers. Philadelphia. Correspondence solicited.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Long & Allstatter Co.'s Power Punch. See adv., p. 285.

Eclipse Fan Blower and Exhauster. See adv., p. 285.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Peck's Patent Drop Press. See adv., page 300.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Wren's Patent Grate Bar. See adv. page 300.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 300.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 301.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Light Machinists' Tools, etc., see Reed's adv., p. 301.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Saw Mill Machinery. Stearns Mfg. Co. See p. 300.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y

Saunders' Pipe Cutting Threading Mach. See p. 301.

The Sweetland Chuck. See illus. adv., p. 269.

For best Duplex Injector, see Jenks' adv., p. 269.

The American Electric Co., Proprts Mfrs of Thompson Houston System of Electric Lighting the Arc Type.

Blake "Lion and Eagle" Imp'd Crusher. See p. 284.

4 to 40 H P. Steam Engines. See adv. p. 286.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 285.

For Machinists' Tools, see Whitcomb's adv., p. 301.

See Bentel, Margedant & Co.'s adv., page 317.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Clark Rubber Wheels adv. See page 316.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Peerless Colors—For coloring mortar. French, Richards & Co., 410 Callowhill St., Philadelphia, Pa,

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 316.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 316.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. J. S. Graves & Son, Rochester, N. Y.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 317.

Akron Rubber Works, Akron, O. Moulded goods and special work of every description.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 316.

Grain Nickel, Nickel Anodes Rolled or Cast, Nickel Salts. Greene, Tweed & Co., 118 Chambers St., N. Y.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 317.

Safety Boilers. See Harrison Boiler Works adv., p. 316.

The Medart Pat. Wrought Rim Pulley. See adv., p. 317.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 317.

Emery, Glue, Composition, Pumice, and all Goods for Polishing Metals. Greene, Tweed & Co., New York.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 318.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Rowland's Vertical Engine. Wearing parts of steel. Broad bearings. F.C. & A.E. Rowland, New Haven, Conn.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 318. Totten & Co., Pittsburg.

Use Vacuum Oil Co.'s Lubricating Oil, Rochester, N.Y.

For Thrashing Machines, Engines, and Horse Powers, see illus. adv. of G. Westinghouse & Co., page 317.

NEW BOOKS AND PUBLICATIONS.

HENDERSON'S HAND BOOK OF PLANTS. By Peter Henderson. New York: Peter Henderson & Co.

Something between a florist's and gardener's manual and a botanical dictionary, paying special attention to such plants and flowers as may be cultivated in this country. A multitude of cross references, giving the common and local names of plants, are a valuable feature of the book, the scope of which embraces also the systematic names of all the leading genera of useful and ornamental plants, with their more important species and varieties, with brief instructions with regard to their propagation. The glossary of botanical and horticultural terms and methods of cultivation is full and useful.

THE WOOL CARDER'S VADE MECUM. By William Calvert Bramwell. Hyde Park, Mass. 1881. Published by the author.

The third and much enlarged edition of Mr. Bramwell's useful manual. Among the additions are three chapters on textile fibers used in connection with wool. The book is now, in general make up, perhaps the handsomest industrial handbook in the maket.

HOW WE FED THE BABY TO MAKE HER HEALTHY AND HAPPY, WITH HEALTH HINTS. By C. E. Page, M.D. New York: Fowler & Wells.

A useful little handbook for young mothers, containing much sensible and practical advice calculated to diminish materially the murderously excessive death rate of young children. Special stress is laid upon the bad effects of over-feeding and frequent dosing of infants.

HYDROPHOBIA. By Horatio R. Bigelow, M.D. Philadelphia: D. G. Brinton.

The author's aim has been to furnish in this monograph a critical digest of the literature of hydrophobia. Contrary to the theory commonly held Dr. Bigelow is strongly inclined to believe that this disease is not primarily one of the nervous system, but a blood disease, which must be treated by remedies acting directly upon the blood.

AMERICAN CHEMICAL JOURNAL. Baltimore Md.: Published by the Editor, Professor Ira Remsen, Johns Hopkins University 8vo, pp. 448. $3.

The second volume of this highly creditable periodical is completed with the February issue. The six numbers contain half a hundred original articles by American and foreign chemists, besides a considerable number of reports on progress in various departments of chemistry, reviews of books on chemical subjects, and many notes and items of general interest to chemists.

MODERN ARCHITECTURAL DESIGNS AND DETAILS New York: Bicknell & Comstock. Part 7. $1.

Includes plates 49 to 56, showing a number of large and small seaside or lake shore cottages, and southern houses, with front, back, and side elevations, floor plans, details, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. B. T. writes: 1. Having read a description of canoe in SCIENTIFIC AMERICAN SUPPLEMENT No. 219. I take the liberty of asking whether said canoe, when built, would be capable of carrying two persons? If not, will you be kind enough to inform me, through your valuable paper, what dimensions are required to carry two? A. For two persons we think it should have 26 inches or 28 inches beam. 2. Will 15 oz. duck be heavy enough to cover deck? A. Yes.

(2) J. D. W. asks how a perfectly transparent water size for gilding on glass is prepared—a preparation that may be easily worked. A. a. Isinglass, 1 oz.; dissolve in just enough water to cover it, and add 1 pint rectified wine spirit, then increase the quantity to a quart with water. Keep well corked when not in use. b. Dissolve ¼ oz. isinglass in ½ pint of rum, add ½ pint distilled water, and filter through a piece of linen.

(3) J. C. H. asks what the chemical constituents of fire clay are, and how it is prepared to manufacture into brick. A. Fire clay is a silicious aluminum silicate—silicate of aluminum mixed with more or less free silica and usually a little iron oxide, etc. The clay is elutriated to separate the coarser particles, the finer portion after settling, draining, and partly drying being well mixed together, pressed into form, dried slowly, but thoroughly, in the air, then fired in a kiln. 2. I am manufacturing hydraulic cement; have always presumed the bond was made by a chemical change. Yesterday I heard of some reported experiments in your city which showed by a powerful microscope that the particles of cement were fibers which, when wet, curled and twined together, thus making the bond. The theory appeared ridiculous to me. Is there anything in it? A. The bond is chiefly chemical. Consult Gillmore's "Treatise on Hydraulic Cements and Mortars."

(4) J. S. B. asks: 1. Will you please to inform me the supply, demand, and price per pound of corundum? A. You can best obtain this information by addressing the dealers who advertise in this paper. 2. Is it probable, should corundum be found in sufficient quantities, that it will supplant the use of emery? What is the relative value as between corundum and emery, both as regards abrasive qualities and value? A. In a measure, yes. The value is determined chiefly by the comparative abrasive qualities—the standard wears away four-fifths its weight of glass. In this respect corundum from different localities varies widely. See articles on corundum and emery, SUPPLEMENTS, Nos. 125 and 42; also papers by J. Lawrence Smith and C. T. Jackson, Silliman's *American Journal of Science* (2d series), vii., 283; ix., 289; x., 354; xxxix., 87; xl., 112 and 123. 3. Is corundum found anywhere in the world except in this State? A. Corundum has been extensively mined at Chester, Pa; it is found also in South Carolina and Alabama, Massachusetts, and on the Pacific coast, in Brazil, Germany, and in South Africa and China. 3. Is it probable that in any reasonable length of time the supply of corundum will exceed the demand? A. Probably not. For other references on corundum see SCIENTIFIC AMERICAN, 405, vol. xxxviii.; 193 and 276, vol. xxxix.; and 113 vol. xlii.

(5) D. K. H. asks how files are measured. I say, for instance, a file measuring ten inches from shoulder to point is a ten-inch file, while a friend claims it is an eight-inch. Which is right? A. The tang of a file is not included in the measurement.

(6) C. H. F. asks: What cheap solution of a glue nature—ignitible, not explosive, can I get to cement fibrous matter together, such as hemp in our common ropes cut up fine; must also be waterproof? A. A solution of shellac in wood naphtha might answer your purpose. See cements, page 2510, SUPPLEMENT, No. 158.

(7) T. S. W. asks: How can I make a liquid stove polish to be applied with an ordinary paint brush, and afterward polished with a stove brush? A. See ans. to L. A., p. 202 (9). Diluted with a sufficient quantity of water the polish there described may be used either as a paste or paint; for the latter it must be ground very fine.

(8) W. L. T. asks: 1. Can mica be dissolved, and if so, to what use can it be put? A. There is no solvent for mica. 2. Do you know of a machine for cutting mica to proper sizes? I have the control of a large mica mine, and will soon commence working it. A. We know of no special machinery for this purpose. 3. Do you know of what use the waste can be used for? A. See "The Utilization of Mica," page 241, vol. xxxiv.

(9) E. H. asks what acid or acids to use for taking out ink spots from ledgers, etc. A. Shake up 2 oz. of good bleaching powder (calcium hypochlorite) with 3 oz. of cold water; let it stand to settle, decant the clear portion, add ¼ oz. acetic acid, and bottle. Dry the paper as quickly as possible with clean blotting paper.

(10) F. Y. asks: Do you know of any preparation that will remove from paper instantaneously ink stains, blots, or writing, made by inks or writing fluids, without injuring the enamel or gloss of the paper, so that it can immediately be rewritten? A. See answer to E. H., above.

(11) O. F. N. writes: 1. I wish to draw negative pictures on glass by scratching with a needle through an opaque film. The finished plates are to be used for the same purpose, and to take the place of photographic negatives of line and dot subjects. Please tell me the best and simplest covering for the glass plates. A. As we understand you, melted beeswax colored with any opaque pigment, or thin asphaltum varnish, will answer very well. 2. Is there any better way to dispense with photography in producing gelatine relief plates? A. We know of nothing better.

(12) O. F. D. asks whether there is an ink made that nitric acid will not affect, or if there can be one made? A. India ink of good quality is not materially altered by cold nitric acid. A solution of good asphaltum in lavender oil, with a little lampblack added, also resists the acid to a considerable extent.

(13) L. M. asks for a receipt for making olive soap, costing not over two and a half or three cents per pound. A. See Cristiani's late work on soap and candles. Address the book dealers who advertise in this paper.

(14) R. H. asks: 1. What are water colors? A. Generally speaking, colors or pigments finely ground in gum water. 2. How are they prepared for coloring printed cards? A. Consult Penley's "System of Water Color Painting," Hatton's "Hints on Sketching in Water Colors," and Gullick and Tims' "Painting Popularly Explained."

(15) D. D. G. writes: I have suspected for two or three years that throwing salt on ice to melt it from stone sidewalks injured the stone, and this winter has convinced me of the fact. Our stone is a sand stone, and from the effects of the salt crumbles and scales off on the top. I account for it by the sudden and extreme cold made by the salt and ice, but find few to give any credence to my suggestions. A. It is quite probable that the use of salt injures the stone in the way you suggest.

(16) W. F. S. asks how to make the solution used in Town's weather glass. A. The materials are dilute alcohol, camphor, sal-ammoniac, and niter. See "Weather Glasses," page 230, vol. xxvi.

(17) G. D. asks for a receipt for a cement for cementing glass. I wish something to cement the joints of glass tanks, the glass to be supported by a light frame. The cement must stand acids and a cyanous solution of metals. A. Melt together equal parts of pitch and gutta percha. See that the glass is free from grease and dry.

(18) H. B. writes: I have two hundred gallons of white California wine, which has got pricked. Can you tell me of any compound that would bring it back to its natural state again without discoloring it? A. See answer to R. S., this page.

(19) R. S. asks if there is a possibility of removing a flavor of acetic acid from wines caused by excessive fermentation, and if so, would like to know a remedy. A. The common remedy recommended in books is to saturate the excess of acid, with chalk, or calcined oyster shells; but such additions made in sufficient quantity to effect the object are apt to destroy the character of the wine and render it sickly. The best and safest method is to mix it with a considerable portion of full-bodied new wine, adding at the same time a little brandy, and in two or three weeks to fine it down. If too acid to admit of this it is better to make vinegar of the wine.

(20) T. H. asks: What is the best material for the lining of an ice chest? A. Sheet zinc is commonly used for lining. The best non-conducting material for filling in the walls is powdered charcoal.

(21) J. A. C. asks how to make fish lines waterproof. A. Boiled oil, 2 parts; gold size, 1 part; shake together in a bottle, and it is ready for use. Apply to the line, thoroughly dried, with a piece of flannel, expose to the air, and dry. After using the line two or three times it should have another coat, the application being repeated when necessary.

(22) J. A. S. asks if there is any chemical solution that will remove the rough outside coating that is on sea shells. I wish to dress them for ornamental shells, but find it laborious and difficult, on account of the roughness, to remove this red coating by grinding. A. Grinding is about the only practical way of removing the red silicious coating. We know of no means of dissolving it without injuring the other portions.

(23) J. J. writes: I wish to make a small boiler suitable for running a small engine, 1½ inch bore 3 inches stroke: what size should it be, and what style would be best and cheapest? A. A vertical tubular boiler having about 6 square feet of heating surface.

(24) O. N. T. asks: How many screw propellers, 18 inches in diameter, 12 inches travel, would be required to exert the same power as two propellers, 4 feet in diameter, 24 inches travel—each propeller with four blades, and driven same speed? A. Seven; but we think six would do the work very well.

(25) W. H. S. asks: What is used to put platinum points on to brass—is it a cement? A. They are either riveted or soldered with silver solder.

(26) W. E. B. asks (1) for a receipt for making a yeast that will be as strong, and that can be used in place of brewer's ale yeast? We wish to use it in making small beer without malt. Or can you give us directions for making ale yeast, where we have not the convenience of an ale brewery? A. Mix up 1½ lb. of wheat flour to a thick paste with water, cover the vessel containing it with tissue paper, and set it aside in a moderately warm place for about a week. Soak a

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bushel of barley in water, let it germinate, then dry it thoroughly. (See article on Lager Beer, page 192, current volume.) Mash this malt in about 8 gallons of water heated to 170° Fah., cover the vessel, and after an hour's standing pour off the liquid, and stir up the malt again with a like quantity of hot water. Let it soak as before, then draw off, mix the liquors, add ¾ lb. hops, and boil for an hour. Cool down to about 90° Fah., and stir in the decomposed dough thoroughly beaten up with tepid water. Keep in a warm place for a few hours, when active fermentation will take place, carbonic acid gas be disengaged, and when the action is complete and the liquid clear, a large quantity of yeast of excellent quality will be found at the bottom.

(27) T. H. C. writes: S. R. B. can remove his wart by using chloral hydrate. Get a little and rub it up with just enough water to make a thick sirup. Apply this to the wart with a match whittled to a wedge shape, carefully so as not to get the chloral on the well skin. It will burn without discoloring, and destroy the surface, which may be rubbed or scratched off and fresh chloral applied. This is infallible, and leaves no scar. If by accident a little gets on the well skin, no harm is done save a slight reddening and soreness.

(28) A. C. L. writes: I was told by one who professed to be a machinist, that a right hand thread could be cut in a lathe by running the carriage to the right. But I believe it to be impossible. A. It can be done. Reverse the motion of the lathe spindle and turn the cutting tool upside down, or place it behind the work.

(29) S. E. W. writes: I have heard that cold pressure upon a boiler, as when testing it with water, strains boiler more than having same number of pounds of steam. Is this so? A. Cold pressure does not strain the boiler more, if the pressure is increased gradually. If injury is done, it is by improper manipulation. The difference in strength, hot or cold, is so small as to be of no account.

(30) L. B. asks: 1. Will you please tell me, through the SCIENTIFIC AMERICAN, how to make a hole about three-quarters of an inch in diameter into the bottom of a glass bottle? A. A three-quarter brass or copper tube used as a drill and supplied with emery and water will cut the hole. You may guide your drill with a wooden guide. Great care should be taken as the work nears completion. 2. How is transparent paint for coloring the glass slides of a magic lantern prepared? A. Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, crimson lake, ivory black, and the coal tar, or aniline dyes, are the principal pigments used. Raw sienna, burnt sienna, copper brown, and vandyke brown are also sometimes used. The coal tar or aniline dyes afford the richest colors, and tints are most transparent, but are unfortunately apt to fade on exposure to white light. The pigments may be ground in oil or water, but ordinary megilp (strong mastic varnish mixed with an equal quantity of pale drying oil) is preferred as the vehicle. Not a drop more than is necessary for properly working should be used, for if the colors are mixed too thin they will run into one another. A thin size of transparent gelatin in hot water may be laid on the glass when water colors are employed. The transparency of many of these colors is heightened by a thin coat of pure mastic varnish, after drying.

(31) H. E. asks (1) how to make the platinum point of a plated blowpipe remain on the instrument. A. It should be screwed on. 2. How can I make an aniline blue ink? A. Dissolve an ounce of good aniline blue in half a pint of hot water, cool and dilute with cold water until it flows properly from the pen. See Inks, SUPPLEMENT, No. 157.

(32) H. B. ask for a recipe for japanning tin covers, cheap. A. Give the ware a coat of good japan varnish and heat it in an oven at about 300° Fah. until properly hardened.

(33) H. J. N. L. asks how to supply himself with a calcium or magnesium light, or other very bright and strong light for a sign, to attract attention now and again, and the cheapest way of manufacturing the same. A. For the lime or calcium light use the jet described in answer to A. M. B. (28), page 123, current volume. The jet is supplied with oxygen and hydrogen (or illuminating gas) from India-rubber gasbags. It is cheaper to purchase the apparatus and bags. See our advertising columns for addresses of dealers in such things. The oxygen is prepared by heating in a copper retort pure chlorate of potash mixed with about one-fourth its weight of powdered peroxide of manganese. The gas given off is washed by passing it through water in a bottle similar to D., in answer to C. M., page 123 (26), current volume, and collected, is then put in the bag. Use a smooth cylinder of good quicklime three-quarters of an inch in diameter and 2 inches long, perforated to fit tightly on the spindle, or shaped with a knife to fit the lime cap. In the magnesium light a thin ribbon of the metal magnesium is placed between slender rollers operated by clockwork, so that the ribbon, when ignited, is fed forward as rapidly as consumed.

(34) J. H. W. asks: 1. Is there any publication existing that gives the names of the different kinds of vegetable, animal, and mineral oils, their gravity, their process of manufacture, their illuminating and lubricating qualities, formulas for compounding, to refine or clarify? Or can you suggest a way I can obtain the above information? A. We know of no single book that will afford all the information required. Consult Wagner's "Chemical Technology," Muspratt's "Chemistry," Ure's "Dictionary of Arts and Manufactures," Knight's "New Mechanical Dictionary," and the encyclopedias.

(35) R. W. H. writes: 1. At a meeting of farmers in Westchester County, the writer stated that the length of rope used for draught made no other difference than its extra weight if the angle of draught were the same, and proved it by the ordinary steel yard and weight close to yard and three feet distant, the cord being balanced. Then arose a discussion on the most effective angle of draught. I was under the impression that it was 18°, but diligent search has failed to give me any information, and I think it a subject of such general interest that I trouble you for an answer through the SCIENTIFIC AMERICAN. A. Gregory says 18½°; a French author 14° to 15°. 2. The parties in charge of portable engines that are left out-of-doors paint boilers once or twice a month with gas tar (that is the tar obtained from the works for making illuminating gas). Is this deleterious, and is there not something better? A. It is not deleterious, but would be better if first heated sufficiently to drive off the more volatile matters. This heating should be done with caution or the vapors will take fire.

(36) F. P. asks: 1. What proportion does the electrical resistance of one copper wire bear to another of half its diameter? A. It is inversely in proportion to its sectional area; that is, the smaller wire would have four times the resistance of the larger. 2. What treatise on electricity can I get which takes up the theory and practical construction of the most approved dynamo-electric machine, and also the induction coil, fully explaining the construction of each? A. Back numbers of the SUPPLEMENT, Prescott's "Electricity and the Electric Telegraph," the "Electric Light," by Higgs, also recent text books on physics. 3. Is an electric light worked direct from the dynamo-electric machine, or is an induction coil inserted? If the latter, is there a circuit breaker in the primary circuit? A. The machine works direct. 4. How much does an induction coil increase the force? A. It does not increase the dynamic force. The electromotive force of a secondary current is very high. 5. What is a condenser as used with induction coil? A. A condenser is a series of sheets of tin foil insulated from each other and connected in alternation with opposite electrodes of the primary circuit, its office being to neutralize the extra current of the primary circuit.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. M. D.—It is a yellow ocher; ground and washed it will make a cheap red or brown pigment.—O. G. S.—An impure kaolin—used in making cheap pottery, tiles, drain pipes, etc.—G. J. H.—Crystallized quartz rock crystal.

COMMUNICATIONS RECEIVED.

On the Coming Treatment of Ores. By J. C. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 19, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Engine, traction, A. O. Frick, Waynesboro', Pa.
Furnace, W. Duryea, Glen Cove, N. Y.
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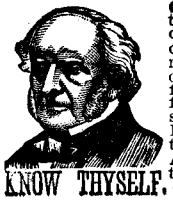

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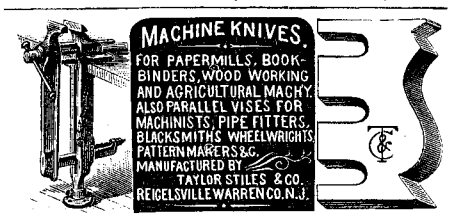
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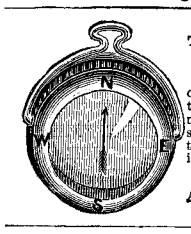

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CONSTRUCTION OF RAILROADS IN BRAZIL.

By order of the Brazilian Legation at Washington the following notice is published:

DEPARTMENT OF AGRICULTURE.—DIRECTORY OF PUBLIC WORKS.—RAILROADS FROM BAGE TO CACEQUY, AND FROM CACEQUY TO URUGUAYANA, IN THE PROVINCE OF S. PEDRO do RIO GRANDE do SUL.

By the present it is made public that the Imperial Government will receive proposals until the 4th of July, 1881, for the construction of the railroads from Bagé to Cacequy and from Cacequy to Uruguayana, in the Province of S. Pedro do Rio Grande do Sul, under the following conditions:

I. The proposals must be presented sealed at the Directory of Public Works of the Department of Agriculture, or at the Brazilian Legations in Washington, London, and Paris.

II. The railroads will have the following lengths:
First—From Bagé, present terminus of the railroad already contracted from Rio Grande to that city, as far as Cacequy, 210 kilometers and 505 meters;
Second—From Cacequy, place where the railroad of Porto Alegre, at present in construction, meets the Bagé railroad, as far as the city of Uruguayana, about 262 kilometers.

III. The surveys already made and approved by the Government for the said railroads will form the basis of the contract.

IV. These surveys, as well as all the documents referring to said railroads, can be examined by the proposers or their representatives at the Directory of Public Works of the Department of Agriculture.

V. The Government grants a guarantee of seven per cent. interest on the capital, which, after the revision of the surveys, will be fixed definitely between the Government and the contractor.
Before beginning the works the contractor must pay to the Government the expenses already incurred for these surveys.

VI. The concession for these railroads will be made in accordance with decree No. 7,957 of 29th December, 1880, in all that relates to the technical part of the construction, and with decrees No. 6.995 of 10th August, 1878, and No. 7,960 of 29th December, 1880, as to the manner of regulating the guarantee of interest on the capital.
The Government reserves the right to grant the construction of both railroads to one single enterprise or to make two distinct allotments.

VII. The time to be consumed in the work and the capabilities of the competing parties will be the main points to be considered.
The companies that have already built railroads, or organized for the construction of these railroads, or persons that from their position and antecedents will offer all the guarantees for the prompt completion of the works contracted, will be preferred for the contracts now contemplated.

VIII. The proposers will make a deposit of 10,000 milreis, or £1,000. Only on presentation of receipt or certificate of this deposit will the proposals be received.
The deposit must be made in the National Treasury, in the above-referred Legations or in the Delegacy of the Treasury in London.
As soon as a proposal is accepted the contractor must increase his deposit to 50,000 milreis, or £5,000, as guarantee of the execution of the contract.
The deposits will be in money or bonds of the public debt of the Empire, and will be forfeited to the Treasury, the first one if the contractor, after the acceptance of the proposal, refuses to sign the contract; the second, if the said contract is not fulfilled.

IX. The Government will impose no clause which is not contained in the Decrees above referred to.

X. It is understood that only after the revision of the surveys and the amount of the guaranteed capital being fixed definitely will the contract agreed upon be considered made and perfect.
The expenses of the revison of the surveys must be paid by the contractor.
If, however, the contractor will not come to an agreement with the Government, the said expenses with the revision will be paid by the parties that will assume the new contract, under the responsibility of the Government, who will indemnify them for all such expenses if the railroad contracted is directly built by the State.
The revision will be made under the immediate supervision of an engineer of the Government.

DIRECTORY OF PUBLIC WORKS, 3d February, 1881.
ANTONIO ALVARES DOS SANTOS SOUZA,
Chief pro temp.

Further particulars can be had by application to the Brazilian Consulate-General, No. 71 Broadway, Room No. 62, New York City.

NEW YORK, April 27, 1881.

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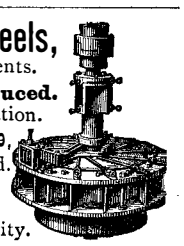

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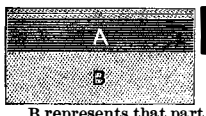
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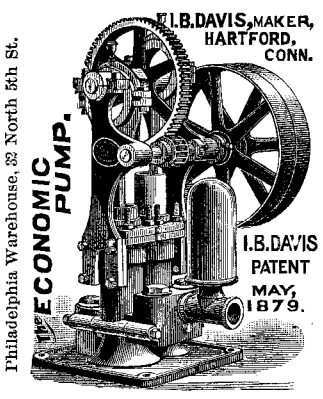
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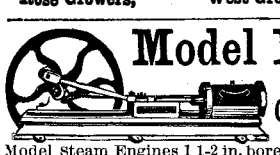
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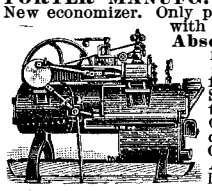
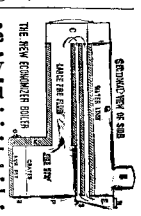

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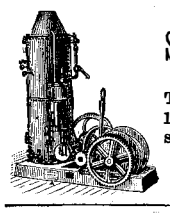
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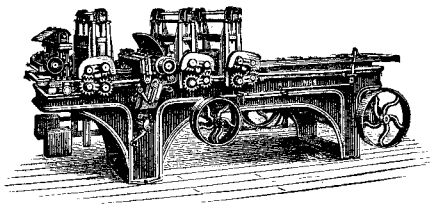
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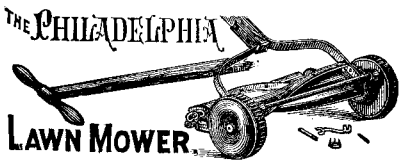
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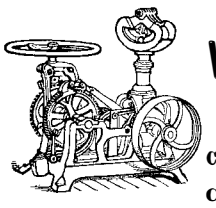
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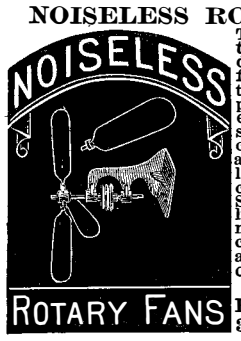

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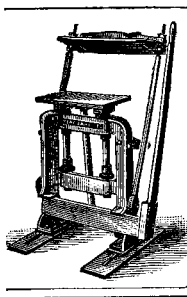

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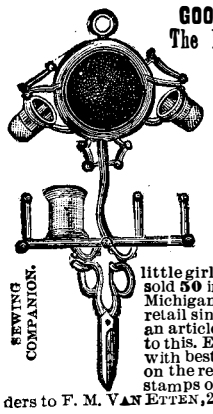

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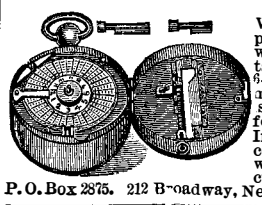

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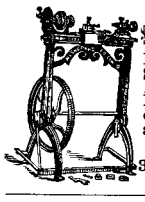

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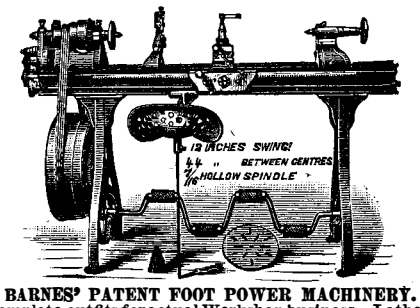

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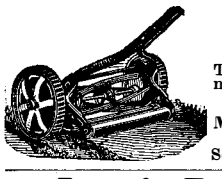

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